

# MODERN Machine Shop

February, 1933



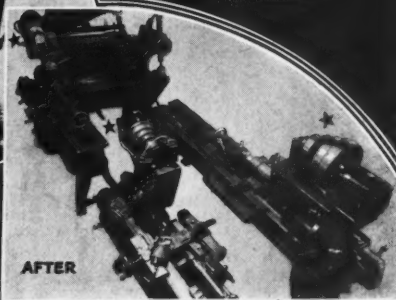
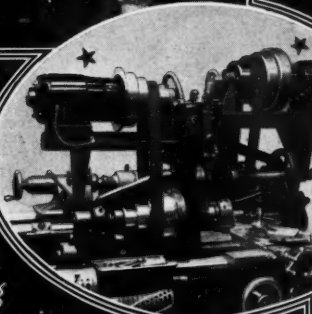
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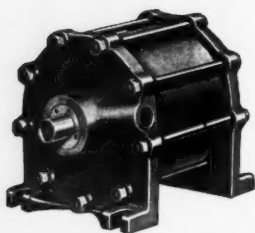
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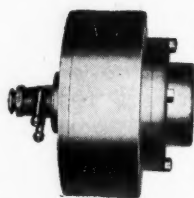
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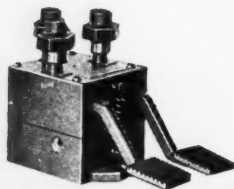
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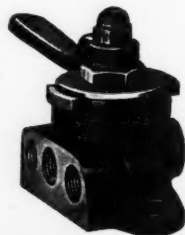
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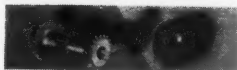
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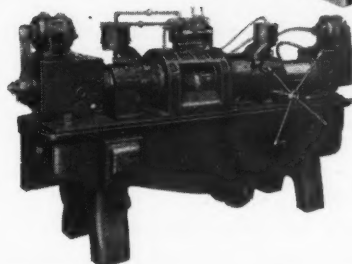
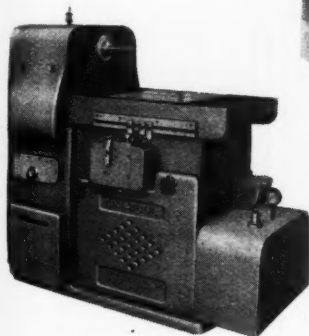
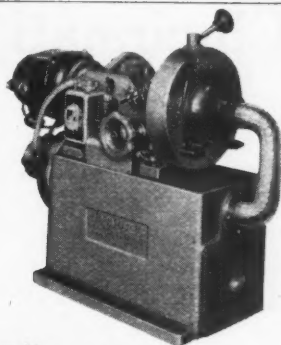
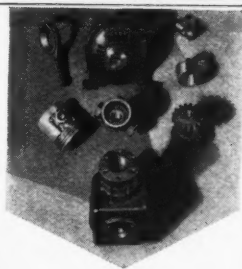
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A radio manufacturer eliminated scores of tapping operations by replacing machine screws with Hardened Self-tapping Sheet Metal Screws. He saved \$16,000 a year, and obtained stronger fastenings.



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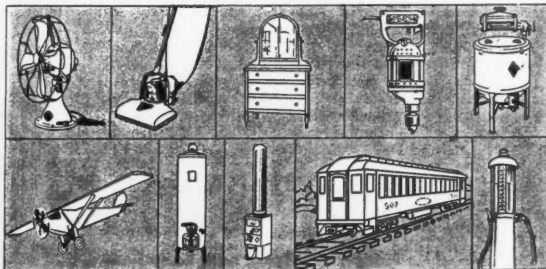
A simple trial will show what Self-tapping Screws can do for you. Return the coupon, with a brief description of one or more assemblies. Our Fastening Specialists will send you unbiased recommendations with a Money-Saver Test Bag of samples for you to try.

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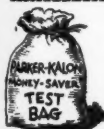


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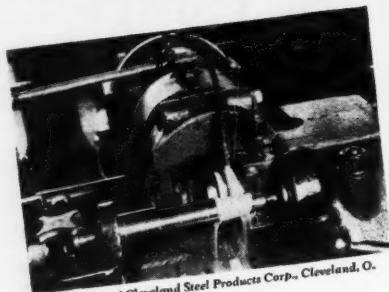
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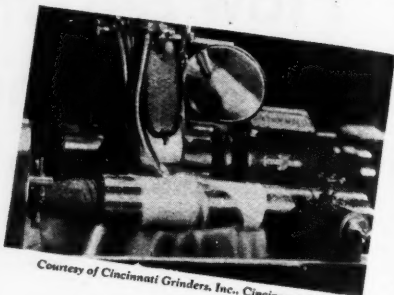
Company \_\_\_\_\_

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*Courtesy of Cleveland Steel Products Corp., Cleveland, O.*

**OPERATION:** MILLING THREAD ON 1 9/16 IN. SPLINE  
SHAFT 20 THREADS  
**MACHINE:** LEES-BRADNER THREAD MILLER  
**MATERIAL:** S. A. E. 3135 STEEL  
**CUTTER:** 3 IN. R. P. M. 156  
**PRODUCTION:** 30 PIECES PER HOUR  
**LUBRICANT:** 1 PART SUNOCO TO 15 PARTS WATER.



*Courtesy of Cincinnati Grinders, Inc., Cincinnati, O.*

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GRINDING WHEEL SPINDLE.  
**MACHINE:** 14 IN. BY 48 IN. CINCINNATI PLAIN SELF  
CONTAINED GRINDER.  
**MATERIAL:** S. A. E. 3145 STEEL.  
**STOCK REMOVAL:** .030 INCH  
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# MODERN Machine Shop

HOWARD CAMPBELL, Editor

Volume 5

FEBRUARY, 1933

Number 9

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*A  
Magazine  
for  
Machine  
Shop  
Executives*



Member



More Than  
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Plant  
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# MODERN Machine Shop

FEBRUARY, 1933

CINCINNATI, OHIO

VOL. 5, No. 9

## Economy Dictates Better Iron for Gear Castings

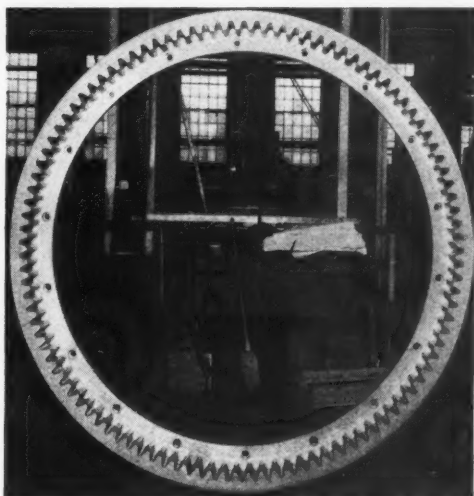
*Small percentages of nickel with or without chromium improve strength, increase wear-resistance, eliminate porosity in heavy sections, avoid hard spots, and insure a superior grade of iron. The actual experiences of several shops are outlined in this article.*

By F. L. MOREHEAD,  
Consulting Engineer

GRAY iron of the ordinary grade presents a number of disadvantages when used for gear castings, especially when heavy sections are involved. For this reason, many machinery manufacturers have resorted to much more expensive materials because they have failed to understand how easy it is to obtain sound castings at very little, if any, net increase in cost. The solution of the problem lies in the composition of the mix and must, therefore, be handled at the foundry. By working closely with both foundry and machine shop, the de-

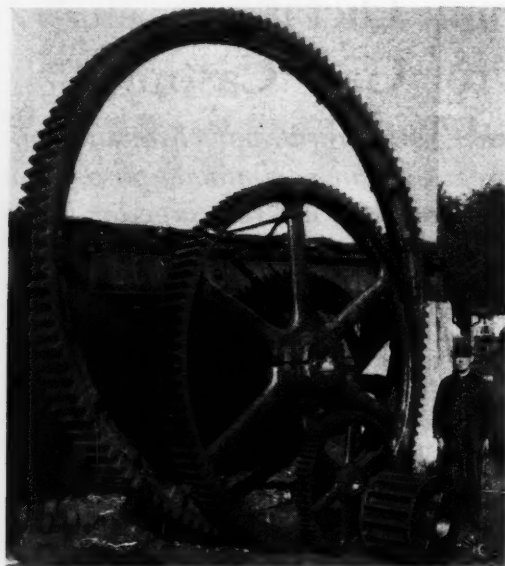
signing engineer will be able to determine the best mix for the job in hand.

By making use of nickel and other alloying elements, gears are now be-



Nickel-iron face plate gear, eight feet in diameter. Teeth are cut several inches into the heart of the metal, at which point the metal is uniformly dense and shows a tensile strength of 33,000 p.s.i.

ing produced which are free from the chilled areas that make machining so difficult, and are also free from the porous and open-grained sections which so often result in the scrapping of castings made from ordinary gray iron. An outline of some of the experiences of Canadian and American manufacturers is presented here for



Large diameter bull gears for drum barkers cast from nickel-iron in a Canadian foundry. The smaller gears and pinions are cast from the same wear-resistant alloy.

the benefit of those who are interested in this subject.

Before citing specific instances, however, a summary of the advantages of nickel-iron for gear castings may prove helpful. First, there is the greater strength of the material, especially in heavy sections where the usual porosity is avoided. Second, the increased wear-resistance, resulting in part from greater and more uniform hardness without chill. Third, the ease with which perfect castings, free from shrinkage and porous sections, are se-

cured. Fourth, the freedom from the hard spots which dull the edges of tools and often cause chipping of chilled edges. Finally, the cost per pound is low — considerably lower than that of other materials of equal or greater strength.

Nickel refines the grain structure of the iron and results in fine dispersion of the free carbon. In some cases, the time saved in machining is of paramount importance. In others, especially where heavy sections are involved, the elimination of open grain and porous spots, particularly at the roots of the teeth where maximum stresses may be imposed, may be the critical factor.

This condition is met frequently when a high silicon content has been resorted to in an effort to improve the machining qualities of the casting. By using even small percentages of nickel, it is possible to employ moderate silicon content and still avoid the chill at edges and thin sections which make machining difficult. Chilled edges, even though they can be cut with some of the modern tools, are likely to result in chipping or breaking away of

the metal as the cutter reaches the ends of the teeth.

It often happens that porous spots in heavy castings, either at the roots of the teeth or in the hub, do not show up until a considerable amount of machine work has been done. It may then become necessary to scrap the casting, with considerable loss not only in the cost of the casting itself, but in the cost of the machining that has been done.

The first important fact to learn in the use of nickel in cast iron is that

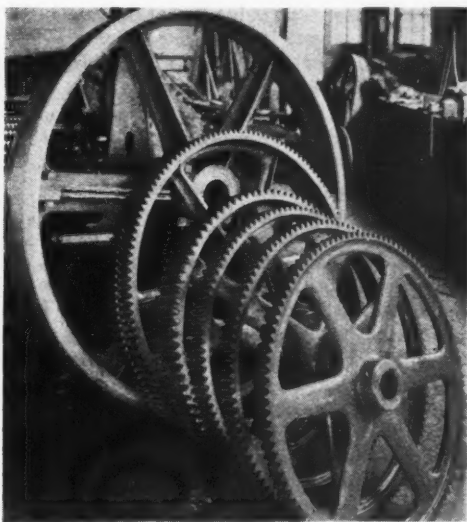


although it increases the hardness of the iron and gives it considerably greater resistance to wear, it does not necessarily make the iron harder to machine. An increase in the amount of power required for machining may be necessary, but the absence of chilled spots — which dull most tools quickly and which particularly are very likely to occur in castings in which a low silicon content is employed to increase density—may actually decrease the net time required for machining. Any slight increase in machining time will be more than offset by the greater wear resistance of the finished gear.

Even when added to ordinary gray iron, nickel effects an increase of some 20 to 30 per cent in strength. In addition, through the elimination of porous spots, it permits of the application of considerably higher stresses with the same factor of safety. Engineers ordinarily rate gray iron at about 15,000 p.s.i. (pounds per square inch) tensile strength, and figure on working it at from 5,000 to 8,000 p.s.i. Properly-made nickel-irons run consistently from 30,000 to 40,000 p.s.i. tensile strength and, because of the consistent results secured, permit of marked reductions in the sections required for a given load.

In foundries where properly-controlled cupola practice prevails, a steel content of 70 per cent or more can be used in nickel-iron mixes, and resultant tensile strengths as high as 50,000 to 60,000 p.s.i. can be secured regularly. Ordinarily, however, around 40 to 50 per cent steel is employed in the mix for a good grade of nickel-iron gear castings. This mix gives a tensile strength of around 40,000 p.s.i. and furnishes a high degree of wear resistance.

The life of nickel-iron gears is 30 per cent or more greater than that of gray iron. If resistance to wear is an important consideration, life can be increased materially by using alloys of 2.5 to 3 per cent nickel with 0.6 to 0.9 per cent of chromium. Wear resistance applies not only to gears which mesh with others of the same material, but also to those which mesh with steel pinions and to sprockets



A group of sprockets cast from a highly wear-resistant iron containing 2 per cent silicon, 1 per cent nickel, and 0.5 per cent chromium. The heavy hubs are dense and there are no flaws at the roots of the teeth.

that run in contact with chain. There is also the added advantage to be gained of less frequent breakage of teeth — which is often a serious matter where cast iron gears are used.

Coming now to specific cases, the gain resulting from the better machining qualities of nickel-iron is illustrated by the following example. It concerns the production of gears weighing 192 lbs. each, requiring 250 lbs. of metal to pour. As originally cast from gray iron, these gears re-



quired an average of nine hours for machining, this average including the time spent on castings that eventually proved to be porous and had to be scrapped. The silicon content of the gray iron was, in this case, from 1.50 to 1.60 per cent. Castings made from an iron in which the silicon was reduced to 1.20 - 1.30 per cent and to which 0.5 per cent of nickel was added resulted in an average machining time of 5.5 hours, or a reduction of about 40 per cent. The added cost of the nickel was about 45 cents per gear, which, of course, was much more than offset by the reduction in machining costs and in the reduction of the percentage of scrap.

As to the effects of porosity, the experience of a well-known manufacturer of heavy machinery in Philadelphia may be cited. In one of the machines made by this firm a gear is used that is 90 in. in diameter and weighs 4,460 lbs. The teeth are cut internally and each tooth is 10 in. long. The rim has a  $3\frac{3}{4}$ -in. cross section adjacent to a 2 x 6-in. flange. The teeth are cut into the rim to a depth of about  $1\frac{1}{2}$  in. When a 20 per cent steel mix was used, even though both external and internal chills were employed, porosity often showed up at the roots of the teeth and in many cases necessitated scrapping the castings. In some cases, also, teeth broke in service.

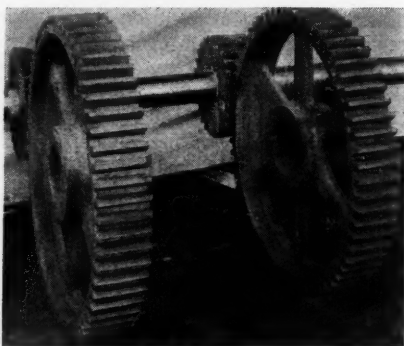
Trouble was finally eliminated by adopting a 70 per cent steel mix of the following analysis:

Total carbon	.....2.90 - 3.00 per cent
Silicon	.....0.80 - 0.90 per cent
Sulphur	.....0.12 max. per cent
Phosphorus	.....0.12 max. per cent
Manganese	.....0.80 - 0.90 per cent
Nickel	.....1.75 - 2.00 per cent

With this mixture no chills were required, porous spots were eliminated, and excellent machinability was

obtained. Tests on a standard arbitration test bar taken from a 6-in. section of this material showed 33,133 p.s.i. tensile strength and 4,235 p.s.i. transverse strength.

Because of difficulties with ordinary gray iron gears, another machinery manufacturer who has his own foundry finally found it necessary to buy nearly all of his gear castings from an outside foundry. When the use of



The use of these nickel-iron gears and pinions enabled a large rubber manufacturer to increase operating speeds on some machines about 40 per cent. The alloy used contained 1.8 per cent silicon, 2 to 2.2 per cent nickel, and 0.6 per cent chromium.

nickel iron was suggested, it was agreed that tests should be made with an iron composed of 45 per cent steel, 30 per cent scrap, and 25 per cent pig, to which should be added 1.25 per cent nickel. An analysis of this mix showed 1.30 per cent silicon, 1.00 per cent manganese, and 3.20 per cent total carbon, the sulphur being held to 0.08 per cent and the phosphorus to 0.20 per cent.

Using this mix, gears were cast having  $\frac{3}{4}$ -in. to  $2\frac{1}{2}$ -in. sections, and pinions were made with 4-in. to 5-in. sections. Tests showed tensile strengths of 41,000 lbs. and transverse strengths of 4,500 lbs. The results were so favorable that this manufac-

turer is now casting all his gears from this iron in his own foundry. This, of course, is no reflection upon cast steel as a gear material, but it shows that nickel-iron can be used with success in applications where ordinary gray iron has proved inadequate.

A somewhat similar experience was encountered by the operators of a large foundry in Troy, N. Y., except that the gears, cast for a manufacturer of presses, were of heavier section. In this case the rim sections ran from  $4\frac{1}{2}$  to 5 in. thick and the face was 8 in. across, sections through the hub being 6 to 7 in. The loss on this job had been nearly 50 per cent, due to porosity, which is characteristic of gray iron in thick sections, and finally all work on the job was suspended.

After experiencing favorable results on heavy-section work in which nickel-iron was employed, they took the gear job back with the understanding that they would be responsible for all loss resulting from porosity. They proceeded to use a mix consisting of 60 per cent steel, 20 per cent scrap, and 20 per cent pig, showing an analysis as follows:

Silicon .....	0.90 per cent
Sulphur .....	0.10 per cent
Phosphorus .....	0.15 per cent
Manganese .....	0.85 per cent
Nickel .....	1.40 per cent
Total Carbon ....	3.00-3.10 per cent

At the last report, no loss whatever had been suffered as a result of porous castings.

In another instance, shrinkage at the base of the teeth of large gears resulted in rejections when porous sections were uncovered after the machining was nearly completed. These gears had an 8-in. face and 4-in. wall thickness, and the shrinkage occurred at teeth near the ends of spokes with approximately  $2\frac{1}{2} \times 5$  in. sections. Substitution of nickel-iron of the following mix eliminated the porosity

and secured excellent machining qualities:

Steel .....	30 per cent
Malleable Pig .....	30 per cent
Scrap .....	20 per cent
Low-Silicon Charcoal Pig.	20 per cent

The analysis was as follows:

Silicon .....	1.00 per cent
Sulphur .....	0.10 per cent
Phosphorus .....	0.17 per cent
Manganese .....	1.00 per cent
Nickel .....	1.50 per cent

The above composition is now standard for this class of work in this foundry.

Gears for rubber-refining mills are among those which have been made with success from nickel-iron. In one case a pair of gears weighing 1,400 lbs. each, meshing with pinions of the same material weighing 580 lbs. each, made it possible to increase the speed of the mill nearly 40 per cent. The same foundry has cast nickel-iron sprockets some 6 ft. in diameter for use with roller chain.

Although chromium is sometimes used in addition to nickel-iron in order to obtain greater strength and wear-resistance in cast iron gears, in most cases where impact and shock resistance are the primary considerations straight nickel-iron is reported to give more satisfactory results. One crane manufacturer, however, casts crane driving wheels integral with gear blanks, using a mixture containing 1.00 per cent nickel and .70 per cent chromium. The chromium gives the desired depth of chill to the wheel rim, and the nickel retains the desired machinability for the gear teeth.

In addition to the applications already mentioned, nickel-iron gears have been used with success on conveyors and conveying equipment, power shovels, cement mixers, hoists (in some cases being cast integral with the hoist drum), cement mills, paper mills, mining machinery, farm machinery, pumps, rolling mill ma-

chinery, and many other types and kinds of mechanical equipment. It is evident, therefore, that its use is well beyond the experimental stage in the machinery field.

Although most of the applications cited are for comparatively heavy work, there is no reason why nickel-iron cannot be employed to advantage in place of cast iron for many of the smaller gears. Its higher strength should permit savings in space and weight, and the advantages of good machining qualities and increased life or resistance to wear cannot be overlooked, even though the cost of the unfinished casting may be slightly greater than the cost of straight gray iron. By increasing the nickel content, hardness may be increased materially without undue sacrifice of machinability. Nickel-iron also takes an excellent finish, adding to the appearance of the finished product.

While it is true that the best results from nickel-iron are obtained from mixes that contain higher percentages of steel than are commonly used in many foundries, such mixes are common in many foundries that do a large business in so-called semi-steel castings. In addition, many of the advantages obtained by the use of nickel can be secured with ordinary gray iron mixes by adding the nickel in the ladle. Thus it is not necessary to run a special heat in order to pour a comparatively few nickel-iron castings. Foundrymen will discover many advantages in the intelligent use of nickel in the production of iron castings.

## New Books

**EDUCATIONAL EXPERIMENTS IN INDUSTRY.** By Nathaniel Peffer. 206 pages, 5 x 7½ in. in size. Published by The MacMillan Company, New York, N. Y. Price, \$1.50.

In a modern industrial corporation the relation of employer to employee is no longer simply that of boss to hired man.

The firm of today is rather more paternalistic in its attitude toward its people. There are company clubs and bulletins, company lunch rooms, company outings, and educational opportunities offered by the company to its workers.

Just what is the education so offered? How is it managed; what are the subjects of study; what is the aim of the whole movement?

This book is a study in cross-section of such efforts. It is a factual presentation of what has been done by a number of large industrial firms, and is in some measure an appraisal of their work. There are numerous examples, drawn from industries of every sort—examples of instruction along purely cultural lines, as well as along the far commoner lines of training for the job. The whole inquiry shows clearly what are the possibilities of education for workers, and what has already been accomplished in that direction.

### Reinecker Worm Grinding Machine.

An 8½ x 11-in., 8-page pamphlet discussing the advantages of ground worms, and describing the Reinecker Worm Grinding Machine, marketed by George Scherr Co., Inc., 128 Lafayette Street, New York, N. Y. Illustrations show the machine and method of setting the wheel head to produce a ground finish on the flanks of a worm gear. Copies gratis upon request.

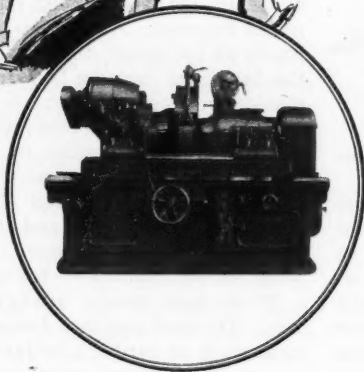
### Automatic Variable Speed Control.

This booklet, issued by Reeves Pulley Company, Columbus, Indiana, describes the Reeves Variable Speed Transmission and explains the advantages that have been secured through the use of this transmission in connection with a large variety of industrial equipment. The booklet is profusely illustrated with both photographs and drawings, and each application is described and discussed in detail. Copies are available to mechanical executives.

### Tilttable Rotary Tables. Pamphlet

No. 556, issued by The R. Y. Ferner Co., Investment Bldg., Washington, D. C., describes three sizes of circular tables which can be tilted through any angle up to 90 degrees for the rapid drilling and boring of slanting or radial holes in tools or work-pieces. Primarily designed for use with Swiss Jig Boring of the Societe Genevoise, the tables are now available for use with other machines. Copies free upon request.

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*Take grinding machines for example*”



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Increased production was the outstanding benefit derived from ceasing to use obsolete machines and an obsolete method. There were other benefits, however, such as greater accuracy, better finish, lower grinding wheel costs, a greater choice of speeds and feeds, greater power, greater accessibility for adjustment and less floor space.

It is quite logical that the Landis Tool Company, manufacturers of precision grinding machines for over forty years, should be showing the way in the direction of reduced costs by the replacement of obsolete grinding machines with modern grinding machines. Give them an opportunity and they will show you.

99

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# Cylindrical Lapping:

## New Light on an Old Subject

By FRED B. JACOBS

**C**YLINDRICAL lapping is an old process, probably dating back at least to the time of those eminent British engineers, Joseph Bramah, 1748-1814, and Henry Maudslay, 1771-1831. It also appears that Leonardo de Vinci, 1452-1519, understood the art, from a theoretical viewpoint at

duce accurate gages to test their work.

Laps for lapping internal cylindrical work are of several kinds, three types being shown in Fig. 1. The form shown at A is the simplest kind of lap to make, but such a lap is a makeshift and not adequate for extremely close work, as its body presents a taper to the work, whereas a lap should fit the work accurately. The lap in question is made of copper or brass and is split at one end as the illustration shows. It is provided with a hardwood wedge for expanding. Thus such a lap cuts at its outer end only.

The form shown at B is a lead lap mounted on a steel tapered arbor. This lap is split to provide for expansion, while the tapered arbor has a half-round keyway. As the lap is cast directly on the arbor, the key to prevent the lap from turning is formed automatically. Such a lap is charged readily and if used correctly is productive of good results on precision work. The lap shown at C is a precision tool for gage and other close work. It is cast iron and its body is split with a slitting saw. A taper-point screw is provided for expanding.

These laps should always be used wet. The best practice favors a lubricant such as lard oil, or lard oil compound. Castor oil such as used for the lubrication of aircraft engines also gives excellent results. Care must be exercised in lapping if accurate results are wanted. If too much

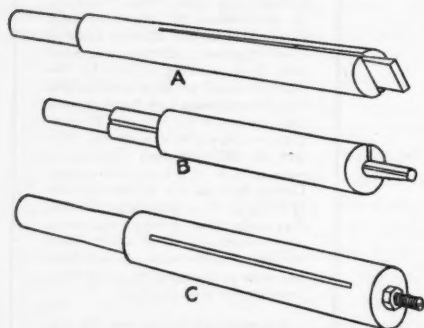


Fig. 1—Three types of laps for internal cylindrical work.

least, as he mentions internal cylindrical lapping in his manuscripts.

It is easy to see why cylindrical lapping was employed in the time of Bramah and Maudslay, inasmuch as cylindrical grinding was unknown at that time, while the value of emery grain as an abrasive material was understood. The early American gun makers (Eli Whitney made guns for the United States government in 1798) understood the art of cylindrical lapping, for without this process it would have been impossible for them to pro-



abrasive is applied to the lap, it will "bank" at the ends of the hole and this will cause the work to be bell-mouthed; that is, larger at the ends than in the middle. Bell mousing

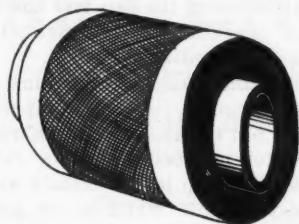


Fig. 2.—Ring gage with projection at each end to insure that the hole in the gage will not be "bell mouthed."

generally is caused by the operator applying abrasive to the lap while the lapping is in progress. To avoid this error the lap should be charged thoroughly with abrasive by lapping a hole in a piece of hard steel. The abrasive will not charge the steel, but the steel, being hard, will force the minute abrasive particles into the soft lap. After the lap is thoroughly charged it is washed in gasoline and is then ready for use. During the lapping operation the lap must be well lubricated. If it is used dry, the action of the work over the lap will tear out the abrasive grains and the work will be scratched.

Thus two methods can be followed in the internal lapping of cylindrical work. One is to apply loose abrasive to the lap while the operation is in process and the other is to charge the lap beforehand. The first method is the more rapid, but it will result in bell mousing. Bell mousing might be of slight consequence on some types of work, such as holes in cam rollers, for example, but it would ruin a ring gage. Even when using a charged lap on gage work some of the abrasive may work out of the lap and bank at the ends of the work to cause very

slight bell mousing. To guard against this, toolmakers often leave a projection about  $\frac{1}{8}$  in. long at each end of the piece, as shown in Fig. 2. After the hole is lapped to size the projections are ground away, leaving a straight hole.

Laps generally are used in a speed lathe as shown in Fig. 3. However, the prevalent tendency is to operate them at excessive speed. A high speed does not result in fast lapping; on the other hand, it wears out the lap rapidly. While no definite rules have been established for the speed of laps, a surface speed of about 22 feet per min. will give good results. Thus a lap  $\frac{1}{2}$  in. in diameter should be rotated at an approximate speed of 250 revolutions per minute.

Many years ago, before the general introduction of internal grinding, it was common practice to finish holes in hardened work entirely by lapping. As a matter of fact, it was common



Fig. 3.—The speed lathe is usually used to revolve the lap.

practice to finish such parts as jig bushings and ring gages entirely by lapping up to 15 years ago. On very accurate work the parts were subjected to two lapping operations;

roughing and finishing. A lead lap with No. 90 to 120 abrasive was used for roughing, and flour grit for finishing. Since the general introduction of efficient internal grinding machines, however, the rough lapping of holes has been dispensed with except in shops where adequate internal grinding equipment is not available.

According to the best present-day practice, holes are ground to within

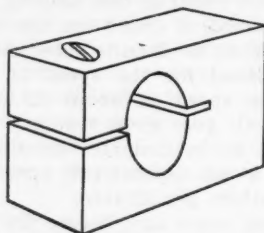


Fig. 4—An external lap.

a few tenths of a thousandth of an inch of the desired size and finish lapped with flour grit abrasive. It is not easy to set a hard and fast rule as to the amount of material to leave for finish lapping, but generally speaking, 0.0002 in. is sufficient to remove the grinding wheel marks, which is the result sought. Thus if a hole is 0.0004 to 0.0005 in. small, the wheel marks will be lapped out in a satisfactory manner. The coarser the wheel, the more liberal the lapping allowance should be.

There are several points to consider when lapping holes accurately. The lap always must fit the work. In this condition it will lap away the high spots first. Never lap a long hole with a short lap. The lap should be longer than the work. If the work is longer and sprung out of alignment in hardening, a short lap would follow the inaccuracy instead of correcting it. The work must not be held in one position during the operation, as its weight might elongate the

hole slightly. To overcome this, turn the work a quarter turn from time to time. Do not expect accurate results if you use an undersize lap and depend on oil and abrasive to make the fit between the lap and the work. A lap operated in this manner produces bell-mouthed holes.

While the foregoing pertains to internal lapping, external lapping is carried out in much the same manner, the difference being that in external lapping the lap is the female and the work the male member, or just the reverse of the conditions in internal lapping where the work is the female member. A cast iron or copper lap for finishing hard steel parts such as gages, aligning bars, and so on, is shown in Fig. 4. As the illustration shows, the lap is provided with a hole so that the lap may fit over the work. The lap is contracted by means of a screw at the outer end of the slot which brings about compression as the screw is tightened.

Just as it is possible to lap internal work bell mouthed, so it is possible to wear a lap such as shown in Fig. 4 out of shape if it is used incorrectly. A lap of this type should be charged carefully by passing it over a rotating piece of hard steel held in the speed lathe while operating the lathe at a slow speed. The speed should be not over 100 r.p.m. for a  $\frac{1}{2}$ -in. hole. The abrasive is applied with oil, a little at a time, in the front of the slot. After the lap is charged it should be washed in gasoline and when in use it should be lubricated with a good oil such as lard oil.

Always bear in mind the fact that a lap is not a stock-removing tool. When used correctly it owes its abrasive action solely to the minute abrasive particles with which it is imbedded. A lap is a finishing tool, and on precision work it should not



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be expected to remove more than a few ten thousandths of an inch.

In the choice of abrasives for lapping, the alumina abrasives such as emery, corundum and manufactured alumina give the best results on hard steel. Emery imparts the highest finish, due to the iron oxide with which it always is impregnated. On the other hand, corundum and manufactured alumina cut much faster than emery. Flour grit is used for finish lapping. When lapping soft metals, great care must be exercised not to charge the work with abrasive. Thus for lapping cast iron, rouge should be substituted for a harsher abrasive. Bronze and brass can be lapped with Vienna lime. These mild abrasives, however, are comparatively slow cutting and cannot be relied on to remove anything but the scratches left by a fine-grit grinding wheel.

The speed for external cylindrical lapping is the same as is employed for internal work; that is, about 22 surface feet per minute. The work is usually held and rotated in a speed lathe and the lap is fed back and forth over it by hand. Sometimes we see an operator hold the lap in a machinists' clamp to obtain purchase enough to take a deep cut. This is not good practice. If a lap such as shown in Fig. 4 cannot be prevented from turning when held in the hand, it is a sign that the cut is too heavy. A heavy cut will not expedite the operation; it will strip the abrasive from the lap and scratch the work. If the lap cannot be prevented from turning when held in the hand, the contracting screw should be backed off slightly.

In testing lapped work, both internal and external, cool it in gasoline to bring it to the room temperature. Otherwise it will be gaged offsize. In lapping work such as plug and ring gages, the plug is lapped to exact

size and then the ring is lapped to fit over the plug so that it can be wrung in place when both pieces are of the same temperature. The plug should be smeared with oil before the ring is wrung over it. An error so small that it cannot be detected with a micrometer reading to 0.0001 in. will cause the ring to "freeze" in place so that pressure is required to remove it.

## New Books

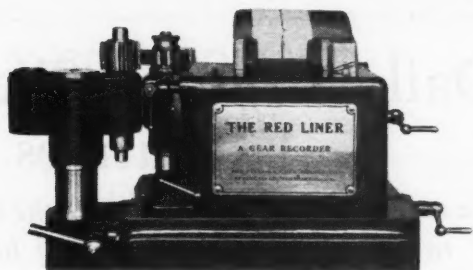
**INDUSTRIAL MANAGEMENT IN THIS MACHINE AGE.** By Francis A. Westbrook, M. E. 424 pages. Published by Thomas Y. Crowell Company, 390 Fourth Avenue, New York, N. Y. Price, \$3.50.

The days when each family was self-sustaining, when each father sheltered and fed his family and the mother clothed her brood, have given way to the Machine Age, in which practically every product—including foodstuffs—is prepared automatically and without the touch of human hands. But the Machine Age, as it has developed, has required, and is requiring, more and more specialized knowledge in its management.

In this volume Mr. Westbrook, himself a mechanical engineer and thus thoroughly able to evaluate the importance of the various functions of modern industry, has laid before his readers detailed descriptions and explanations of the manner in which well-known manufacturers have solved their problems. In the preparation of his material, the author personally visited and corresponded with the managing executives of many successful plants and has studied the methods about which he writes at first hand.

His findings are presented, not in textbook style, but by the use of the illustration method. He has presented industry with a valuable document; one which will, by reason of its data, interest the student of economics or management both in and out of college. At the same time, it will prove invaluable to the plant manager or executive who wishes to profit by the experience of those who have gone before. The text is well illustrated by charts.

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# Daily Control Sheet For Executives

*Here is a control form that will enable the managing executive to "take the temperature" of his business every twenty-four hours*

By WALDO HUTCHINSON

**T**HE purpose of the Daily Control Sheet is to give the executive, day by day, the significant facts concerning his business. Such facts must necessarily be few, summarized in form, and in some cases approximated rather than one hundred per cent correct. If the picture presented to the executive is satisfactory, the report is noted and filed. If the situation is disturbing, however, the executive will call for additional information on specific items so that he may readily change plans or policies.

The Daily Control Sheet will naturally vary in form with the requirements of particular establishments, hence it is to be understood clearly that the form presented is merely suggested, and that it is expected that each concern will adapt the same to meet its own needs.

The Daily Control Sheet attempts to unite in a single form the facts concerning Finances, Orders and Shipments, Production and Operations. The information given of a financial nature is fairly well standardized and requires perhaps little comment. The blank calls for information concerning cash receipts, cash disbursements, bank deposits and balances, bank loans, accounts receivable, accounts past due, and the accounts payable. The amounts of accounts past due are

given so that the executive may act quickly to save accounts which appear doubtful.

The production order and shipments section is designed to show the relation between orders received, goods shipped and goods produced. It is expected that the executive will establish a form, standard, or budget of what ought to be produced and what orders should be received and shipped daily.

In addition to this daily record, cumulative totals for these items are shown, which cumulative totals it is advisable to compare with the corresponding period of the previous year.

The information given under "Operations" is designed to give the executive some idea of the time lost in operation, and of the material scrapped or spoiled. If these items appear unduly large, the executive can investigate the causes and suggest or work out corrective measures. There is also given the number of employees by occupation, both actual and in comparison with the standard, so that the executive may be able to note the effect of a rise or fall in production upon the number and types of men actually employed. The number of men hired and discharged is provided for. If the number discharged is ex-

*(Continued on page 27)*

# DAILY CONTROL SHEET

-----COMPANY

-----DATE
 -----

## FINANCES

Cash Receipts .....			Accounts Receivable .....		
Cash Disbursements .....			Accounts Past Due .....		
Deposited in Banks .....			Accounts Payable .....		
Bank Balance .....			Bank Loans .....		
.....			.....		
.....			.....		
.....			.....		

## PRODUCTION ORDERS AND SHIPMENTS

	TODAY			MONTH TO DATE			Same Period Last Year	
	Quantity	Value	% of Normal	Quantity	Value	% of Normal	Quantity	Value
Production .....								
Orders .....								
Shipments .....								
Unfilled Orders .....								

## OPERATIONS

TIME LOSS:	Man or Machine Hours	% Stnd. Oprtg. Hrs.	Material Scrapped or Spoiled:	
			Quantity .....	Value .....
a—Shortage of Labor			% Actual Productn. ....	
b—Shortage of Material			Employees:	NUMBER
c—Shortage of Work			By Occupation	Standard Actual
d—Shortage of Equipment				
e—Breakdown of Equipment				
f—All Others				
Total:			Hired .....	Discharged .....

# Correct Tapping--

## and Its Relation to the Proper Selection of Tapping Devices

By R. WETZEL,  
Vice President,

The Charles L. Jarvis Co., Gildersleeve, Conn.

**T**HE origin of the screw thread is undated, as the first attempt to join two or more pieces of work by producing ridges on one piece to fit corresponding grooves in the interior of another piece cannot be traced. However, screw threads in a more or less crude form came into being perhaps three hundred years ago, and constituted an important step in the progress of the mechanical arts.

Subsequently each artisan produced threads according to his own ideas. The first attempt at securing uniformity in screw threads was made by Sir Joseph Whitworth about 1841, and in the course of the next twenty years the Whitworth system gradually displaced the previous varied assortment of thread designs. Eventually some sixty thread systems were evolved, which now, thanks to standardization, have been reduced to eight.

All tapping was

originally done by hand, which was a slow operation. As the necessity for increased production on this operation became evident, various devices were designed with which taps could be driven by power. Undoubtedly more than 100,000 tapping devices of various designs, makes, and capacities have been made and used in the last three decades, with varying degrees of satisfaction. An

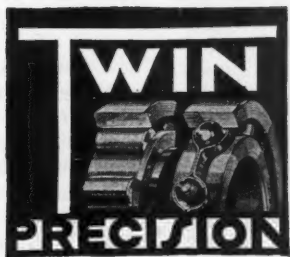
extensive investigation into the performance of tapping devices, however, has shown that where the devices are properly used, they stand up under their task almost indefinitely. Large numbers of tapping devices of more improved design are to be found working constantly at top speed in the production lines of our modern manufacturing plants, giving continuous service under gruelling conditions.

At the same time there are many



Fig. 1—Modern type of tapping device in use in a three-spindle drill press.





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business has been built, and upon which it must continue to grow.

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tapping devices still in operation which can only be classed as "antiques" and which should by all means be replaced with modern equipment. The latter will be found in the smaller plants or in jobbing shops where the maintenance of a production schedule is not imperative and where the extra costs of inefficient tapping are not so apparent. Every machine shop ex-

vices used today range in price from \$28 to \$45. So far as tapping is concerned, it is possible to write off a new tool in a few weeks.

Several months ago the writer visited a fairly large shop in which two very old tapping devices were in use. The job required the tapping of approximately 1,000 holes a day, but it was obvious that the two tools were

in no shape to complete the task in the set time. In addition, it was so difficult to hold the taps properly that many perfectly good taps were broken, thus increasing the time on the job and adding to the cost. An investment of about \$50 in a tapping device of new and improved design took the grief out of this job and put it on a paying basis. Not only was \$1 or so saved on taps each day, but the tapping time was cut down from 12 hours to about 2 hours, or a saving in time of 84 per cent. The tremendous

saving in this case is obvious.

In another case, although a modern-type tool was used, the job was grossly inefficient. The task consisted in tapping a number of  $\frac{3}{8}$ -in. bottom holes in steel, for which a friction tool of  $\frac{1}{2}$ -in. capacity was the only tool available. It could easily be seen that this tool was both too slow and too heavy for the job, resulting in loss of time and abnormal tap breakage. By replacing the tool with a small high speed device with double reverse speed and forward as well as reverse friction clutch, production was multiplied by four and the breakage of taps was eliminated. In this case an investment of some \$40 produced a saving in time and in taps of approxi-

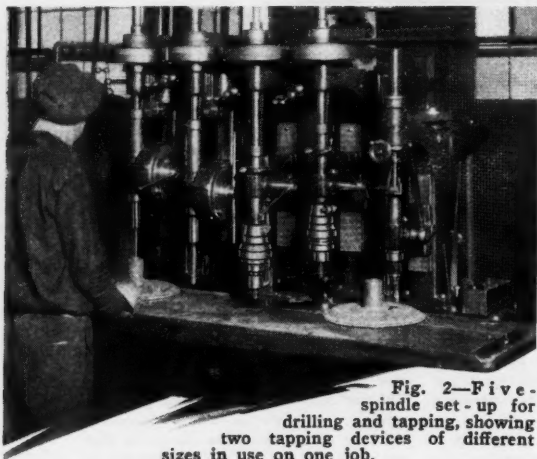


Fig. 2—Five-spindle set-up for drilling and tapping, showing two tapping devices of different sizes in use on one job.

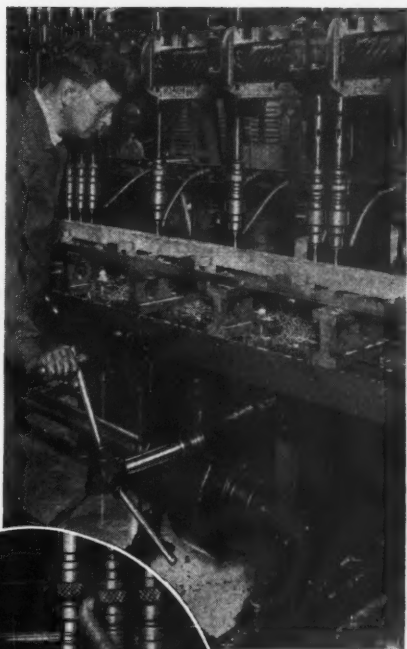
executive knows—but is prone to forget—that more time and money can be wasted in trying to operate a worn-out or badly-designed tapping device than a new device would cost. In these days when costs are of first importance, it is poor economy to not only narrow the already slender margin of profit, but also run the risk of losing business, through the use of tools that have outlived their usefulness.

Tapping, while one of the most important, is one of the cheapest operations in the plant, from a standpoint of cost of equipment. It is a fact, though seldom taken into consideration by mechanical executives, that the vast majority of the tapping de-

mately \$9 per day. And this case could be duplicated in thousands of plants.

Today, more than ever before, the necessity for new lows in manufacturing costs is imperative. Every possible saving must be made. And tapping is one operation on which more money can be wasted through the use of poor tools, and more money saved through a comparatively small investment, than is possible on the majority of machine shop operations. The mechanical executive who has previously overlooked this point should have his tapping equipment inspected—taking into consideration the work that is to be done—and the following points noted:

Fig. 3—An interesting set-up for drilling and tapping holes in metal fence posts on a high production basis. All spindles are equipped with tapping heads, in which quick-change chucks are used so that the posts can be both drilled and tapped without changing the heads.



5. Type of drill press available, and its speeds.

6. Type of tap to be used.

Great care should be exercised in the selection of the proper taps, as there are many types and designs of taps from which to choose.

In ordering new tapping devices, if the above information is given to the manufacturer of the device or his representatives, it will insure that the most efficient device for the job in hand will be selected.

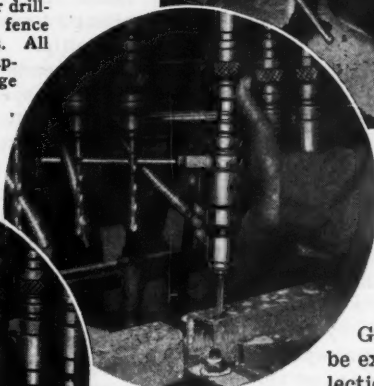
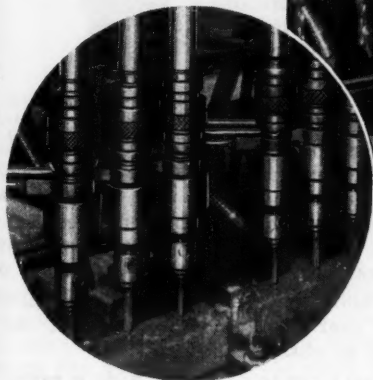
Tapping devices generally are of six types, as follows: Positive forward and positive reverse (Fig. 4), positive forward and positive reverse, but equipped with adjustable friction slip chuck (Fig. 5), forward built-in fric-

1. Size and type of thread to be tapped.

2. Material to be tapped.

3. Bottoming, through tapping, or pipe tapping.

4. Percentage of thread required.



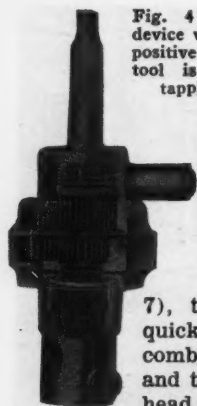


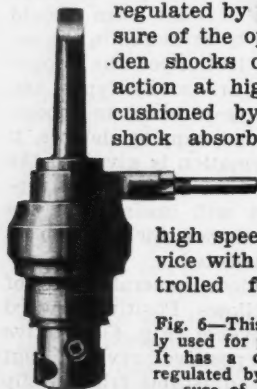
Fig. 4—Positive-type tapping device with positive forward and positive reverse ball clutch. This tool is excellent for through tapping and pipe tapping.

tion, hand pressure controlled, and shock absorber type with positive reverse (Fig. 6), forward and reverse friction (Fig. 7), tapping device and quick change chuck combination (Fig. 8), and the multiple tapping head (Fig. 9).

The positive-type taper illustrated in Fig. 4 has positive forward and positive reverse ball clutch. This tool is mainly used for through tapping, but it also makes an excellent tool for pipe tapping.

The same tool, but equipped with an adjustable friction slip clutch, is shown in Fig. 5. The friction clutch makes this tool especially suitable for general shop work, as it facilitates bottom-tapping without the danger of tap breakage.

In Fig. 6 is shown a tapping device that is used mainly for production work. The clutch is of the cone type, regulated by the hand pressure of the operator. Sudden shocks of the reverse action at high speeds are cushioned by a built-in shock absorber.



In Fig. 7 is shown an ultra-modern high speed tapping device with pressure controlled forward and

Fig. 6—This taper is mostly used for production work. It has a cone-type clutch, regulated by the hand pressure of the operator.

with double reverse friction, also double speed in reverse. This tool can be run as fast as the drill press and the material to be tapped will allow, and has a capacity of up to  $\frac{1}{4}$  in. in steel. It is equipped with ball bearings throughout, and is encased in a special alloy housing.

Where a number of holes of various sizes are to be drilled, reamed, counterbored, and tapped, a tapping device equipped with quick-change chucks and a variety of collets is of great advantage. Such a device is shown in Fig. 8. This combination entirely eliminates the delay of stopping and starting the machine in order to change tools.

Multiple tapping heads are usually especially designed for the task in hand. An upper body is used similar to the one illustrated in Fig. 4. Multiple tapping devices make possible a great saving in mass production, not only through the simultaneous tapping of a great number of holes, but also through the elimination of unnecessary handling.

Following are a few rules which the user of tapping devices will do well to observe:

Don't try to cover too wide a range with one device.

Select the proper style of tapping device for your job.

For steel, figure about 25 per cent less capacity than the ratings for cast



Fig. 5—Tapping tool equipped with adjustable friction slip clutch, especially suitable for general shop work.

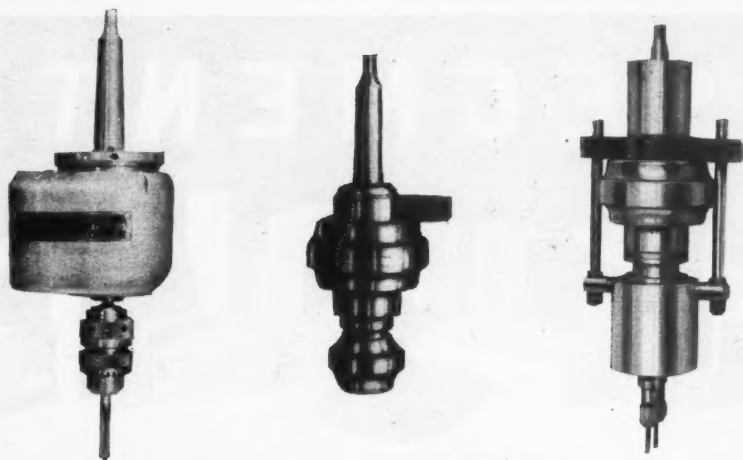


Fig. 7 (Left)—An ultra-modern high-speed tapping tool with pressure controlled forward and double reverse friction clutch, also double speed in reverse. Fig. 8 (Center)—Tapping device equipped with quick-change chuck for multiple-operation work. Fig. 9 (Right)—Multiple tapping head, used in mass production.

iron. Drill the holes for about 75 per cent thread; if the hole is drilled too small, the tap will bind—and this is particularly true if the material is steel.

For small work and fine pitches,

don't expect 100 per cent results from a device that is too large. An extra tapper of the right size will more than pay for itself in time and taps saved.

*(The author of this article will be glad to answer any questions regarding tapping and tapping problems.)*

## Daily Control Sheet

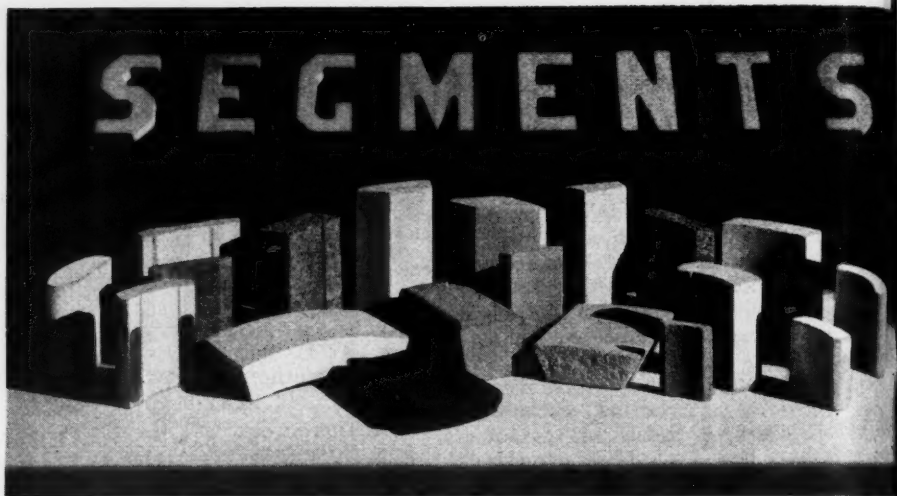
*(Continued from page 21)*

cessive, the manufacturer will probably call in his personnel man for an explanation.

It is expected that this Daily Control Sheet will involve no new administrative machinery. The various reports will be sent in to the president's secretary or assistant, who can quickly assemble the same on the regular form for submission to the chief executive. The entire operation of so assembling the facts should not take more than ten or fifteen minutes. The information relating to finances will be supplied by the general ledger accountant, cashier and credit man. The

sales manager and shipping clerk will be responsible for the information concerning orders and shipments, the production manager, factory accountant and personnel man for the information relating to operations and production.

The Daily Control Sheet is intended to supplement, not to supersede, the weekly analysis of the payroll, the weekly statements of purchases and of delinquent deliveries, of raw, processed and finished material on hand, the monthly statement of assets and liabilities, of earnings, and monthly analysis of sales, of material consumed, of factory burden, cost variations, and so on.



## For All Kinds of S on Machines of These Types —

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Diamond  
Pratt & Whitney  
Bridgeport  
Hanchett  
Rogers  
Crossley  
Capital  
Springfield

**NORTON COMPANY, WORCESTER, MASS.**

New York Chicago Detroit Philadelphia Pittsburgh Hartford Cleveland  
Hamilton, Ontario London Paris Wesseling, Germany

IDEAS FROM READERS

## of Surface Grinding

**T**HERE are many surfacing jobs where segmental wheels will do the work as well as, or even better and cheaper than, the solid types of cup or cylinder wheels. And three features of Norton Segments—38 Alundum abrasive, "B" bond and Controlled Structure—are enabling them to radically reduce grinding costs for many concerns.

Norton Segments are available in all the common sizes and shapes for all the popular makes of machines and chucks—also in many special shapes. You'll find Norton Segments accurate in contour and dimensions—uniform from segment to segment and from lot to lot.

If you are not already using Norton Segments it will pay you to try them—lower costs are mighty welcome these days.

W-440

**NORTON**



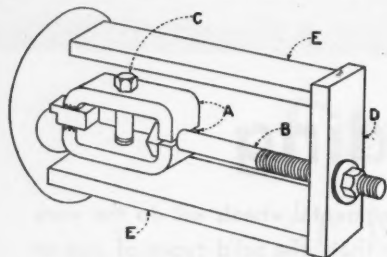
## IDEAS FROM READERS

This department is a clearing house for ideas . . . If there is a "kink" or short cut in use in your shop, send in a description of it . . . We will pay for each one published.

### A Simple, But Efficient, Key Extractor

By CHARLES H. WILEY

**T**HE ease and facility with which some very efficient tools can be made and the excellent results that may be obtained from such tools in-



Key extractor in position for use.

vite special effort in this direction. Such a tool is shown in the illustration. This tool is used to remove the ordinary type of straight keys from work that is being disassembled, and in many cases simplifies an otherwise difficult job.

The tool consists of the two pieces A, locked around the bolt B, and held together by the short bolt C. The end of the bolt B is inserted through a hole in a piece of steel plate D, and the tool is completed by the addition of the two pieces E. The only special parts required are the pieces A, which have to be curved at the ends and serrated to obtain the necessary grip when clamped onto a key. These two parts should be made of tool steel and tempered, and of the size best adapted

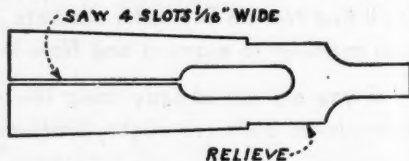
to the work in hand. The bolts are standard, and the three pieces of steel plate can be sawed from a bar.

To use, the pieces A are clamped onto the key, then the distance pieces E are placed in position and the key is withdrawn by turning the nut on the end of the bolt B. The tool gives satisfactory results and can be used on headless keys, as well as those with heads. Our maintenance department has several of these tools, of different sizes, and finds them very valuable for the work for which they are intended.

### Collect for Holding Taper Shank End Mills

By M. C. HAYDEN

**T**HE drawing shows the design of the collets that we use to hold small taper shank end mills. The collet is originally a No. 1, 2, or 3 standard Morse taper sleeve. We place it between centers and turn the



Collet to hold taper shank end mills.

upper end for a short distance to relieve it as shown, then we saw slots in the taper part back as far as the relief. To use, we insert an end mill into the sleeve and drive the sleeve into a holder of the usual type. The



split sleeve contracts and holds the mill better than it can be held by any method we have ever used.

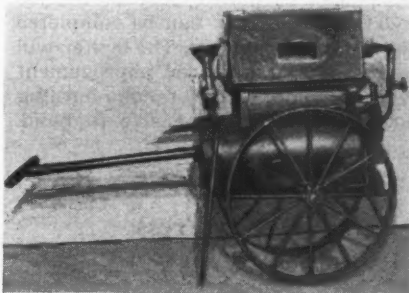
## Oil-Burning Rivet Heater for the Locomotive Shop

By H. H. HENSON

THE accompanying photograph and drawing illustrate a simple, but efficient, rivet heater for the locomotive shop. The heater consists of a reservoir of about ten gallons capacity, upon the top of which is mounted a brick-lined furnace. The photograph shows the heater mounted on wheels so that it can be moved about the shop, and the drawing shows how the heater can be mounted on legs for permanency. Kerosene is used as fuel, and is atomized by means of compressed air from the shop air line.

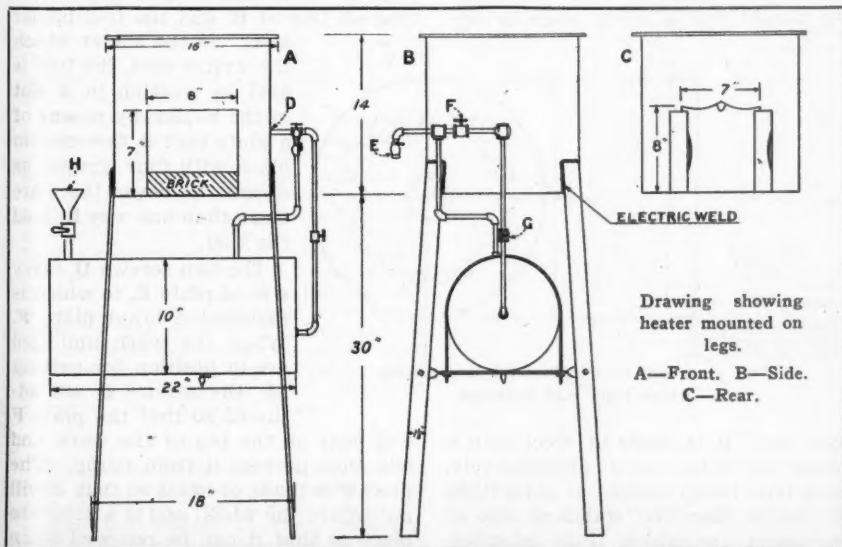
Referring to the drawing, it can be seen that the oil is atomized at the point D, where the nozzle enters the end of the furnace, the air hose being

connected to the pipe at E. The supply of oil and air is regulated by means of the two  $\frac{3}{8}$ -in. globe valves F and G. The oil is poured into the tank through the funnel H, a cut-out



Portable rivet heater for locomotive shop.

cock being located in the pipe line just below the funnel. The side opening in the furnace is 5 x 8 in., and there is also a 2-in. hole in the top of the furnace through which the rivets may be dropped. The legs and door slides are welded in place.



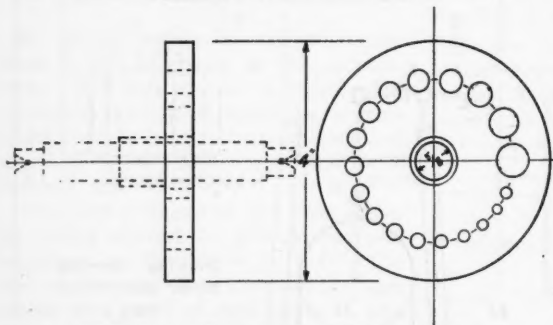
The portable heater will be found very useful for many purposes, as, for instance, when a piston bull-ring is to be riveted onto the spider for a hurry-up job in the engine house. The heater can be pulled close to the job and the whole task can be completed in possibly 15 minutes. The heater will be found to be a decided improvement over the older type of coke-burning furnace, and is inexpensive to build.

## A Handy Plate for the Arbor Press

By SYDNEY FRENCH

EVERY toolmaker will recall having made trips to the arbor press to remove thin steel bushings from an arbor, only to find that the openings in the jaw plates were too large for the bushing, leaving as a possible course of action a search for a scrap collar or other piece by which the bushing could be held while the arbor was pressed through.

The plate illustrated in the drawing should find a ready place in any



This plate will be found useful in removing arbors from thin bushings

tool box. It is made of steel with a series of holes sized progressively, each hole being reamed at least 0.003 in. larger than the standard size of the arbor for which it is intended.

The plate is hardened after machining, and the sides are ground parallel. It can be made any size, depending upon the number and sizes of the holes. A plate 4 in. in diameter and  $\frac{1}{2}$  in. thick will easily accommodate 18 holes ranging from  $\frac{1}{8}$  in. to  $\frac{5}{8}$  in. diameter in steps of  $\frac{1}{32}$  in. For convenience the hole sizes should be stamped adjacent to the holes as a ready reference.

## Support for Cutting-Off Tool

By F. J. WILHELM

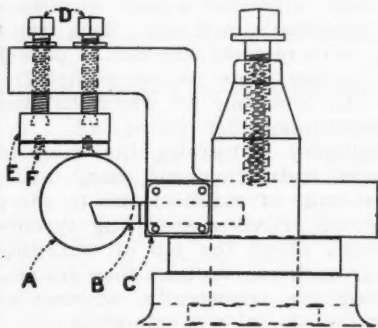
NO mechanic is fond of the job of cutting off stock in the lathe, but there are many cases where it has to be done. However, the tool shown in the drawing will eliminate most of the grief of the cutting-off job, as it is designed to prevent the work from springing upward and will thus prevent the tool from digging in and breaking off.

The drawing is a cross section view, with the work indicated at A, the cutting off tool at B, and the tool holder at C. In the holder which the writer uses, the tool is held in position in a slot in the holder, by means of a plate that is fastened in place with four screws, as shown. However, there are more than one way to hold the tool.

The two screws D carry a steel plate E, to which is fastened a brass plate F. When the work and tool are in position for cutting off, the screws D are adjusted so that the plate F

will bear on the top of the work and will thus prevent it from rising. The plate F is made of brass so that it will not injure the work, and is a separate piece so that it can be renewed when

necessary. By replacing the plate F with a plate in which a Vee has been cut, this holder will be found valuable for use in turning small-diameter



Cutting-Off Tool Holder with support to prevent work from springing.

shafts. The Vee-plate then acts as a follow rest and prevents the shaft from springing away from the tool.

**Houghton On Liquid Baths for the Heat Treatment of Steel.** As we learn more and more about the science of metallurgy we come to the inevitable conclusion that the method of heating the work is one of the most frequent causes of rejections and failures in the heat treatment of steel parts.

The research staff of E. F. Houghton & Co. has devoted a great amount of study to this subject, the results of which are summarized and presented in this 6 x 9-in. booklet. The book contains a chapter on the Design and Operation of Furnaces for Liquid Baths, in which twenty requirements for such a furnace are outlined in detail, with cross section drawings. The book also includes descriptions of the different salt baths made by this firm, with information as to the particular uses for which each is intended. A copy can be had by writing to E. F. Houghton & Co., 238 West Somerset, Philadelphia, Penna.

The most progressive manufacturer can give you the best service. The manufacturers represented here are among the leaders in their industry; patronize them and mention MODERN MACHINE SHOP when doing so.

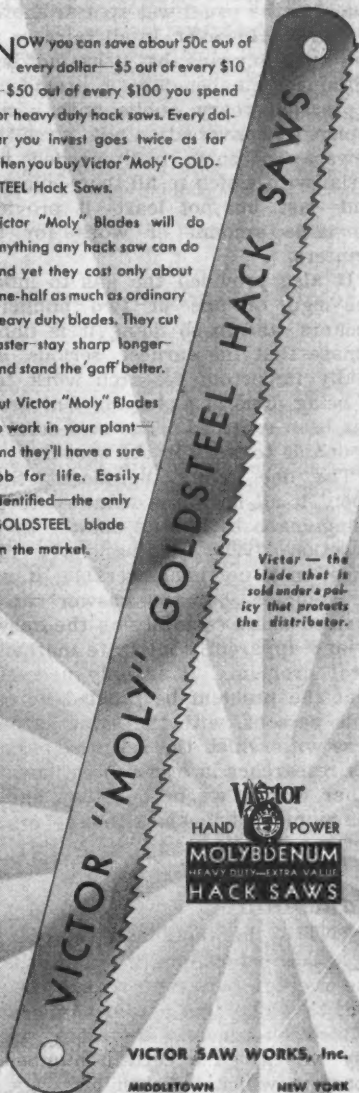
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## Over the Editor's Desk

*Plop!*

THE bubble of "Technocracy" has burst—and without leaving so much as the usual wet spot or shower of spray. However, in all fairness we will have to grant that it has not been without some benefits; it provided a depression-weary public with a new topic of conversation; it gave the newspapers some badly-needed material with which to fill their columns, and—last, but not least—it provided no little amount of work for the printers.

It also provided the gas to inflate the ego of one or two publicity-seekers, and in so doing it is unfortunate that the earnest, serious, and really important research work that is being done at Columbia University has been retarded. The real scientist is unable to work in the spot-light.

The one really significant thing about it all is that a definite effort is being made to find an answer to the question "Why depressions?" The question is not unanswerable; it may be complex, but the answer can be arrived at as certainly as the answer to any apparently intricate mathematical problem. It is only necessary that the problem be tackled by capable persons, with the same earnestness with which the scientist pursues his researches in other directions. In other words, we need action, and at the moment it looks as though we are getting it.

### Education

UNTIL the facts and figures are laid before him, it is difficult for the average person to realize the extent to which this nation has become "education-minded." In years past, a boy was given a certain number of years in which to learn his trade or business, and what he absorbed in this

length of time was very largely up to him. If an apprentice didn't learn enough to become a good workman, he remained a poor one. Such training as he received was usually passed on to him, more or less grudgingly, by the mechanic to whom he was assigned as helper.

Industry is learning the value of special instruction, and many industrial units of sufficient size to carry on such activities are going systematically about the job of educating their workers. At least they are providing the opportunity, whether or not the education is obligatory.

We have just been reading Nathaniel Peffer's book "Educational Experiments in Industry," in which Mr. Peffer outlines the progress that has been made by various industries in the matter of education. It was quickly discovered that a man who had been trained for his particular job produced enough more, and of sufficiently better quality, to justify the extra expense. But—what is more interesting—it was also found that when a worker is given an opportunity for education along "cultural" lines, his interest in his work increases and he becomes not only more satisfied with his job, but he also produces more and better work. It is the old Greek philosophy of liberal education—"Give education, and training comes automatically."

The value of educational facilities for employees is recognized by the more progressive industries, yet nothing is done by way of education for the majority of the workers. As normal conditions return, the more progressive plant managers will undoubtedly be interested in what is being done along this line. Accordingly, MODERN MACHINE SHOP will publish, at intervals through the coming year, descriptions of the educational methods that are in use in well-known plants.

# NEW SHOP EQUIPMENT

## Special Natco Two-Way Multiple Operation Machine

The illustration shows a Special Natco Two-Way 4-headed combination drilling, counterboring, facing, chamfering, countersinking, and tapping machine which will be used on the 1933 production line of a prominent manufacturer of a low priced six-cylinder car.

The two large units which perform all the operations excepting the tapping are equipped with the Natco Hydro Uni-power system of hydraulic feed, which is semi-automatic in operation. In addition, both units are equipped with a time delay reverse and positive stop. The tapping heads are driven by a single reversing motor drive unit and each spindle is equipped with an individual lead screw. The latter insures the correct lead on each tap and is a patented Natco feature.

A five position automatic indexing trunnion type fixture, arranged to hold one cast iron cylinder block in position, was furnished with the machine.

The machine is semi-automatic in operation and is interlocked to prevent indexing of the fixture before the heads are in correct position, also to prevent heads from

starting before the fixture is in its correct position. The operator has complete control of machine through the use of one push-button station. The machine performs a total of 18 different operations for the distributor shaft hole on the two sides of a cast iron cylinder block at an approximate rate of 75 per hour.

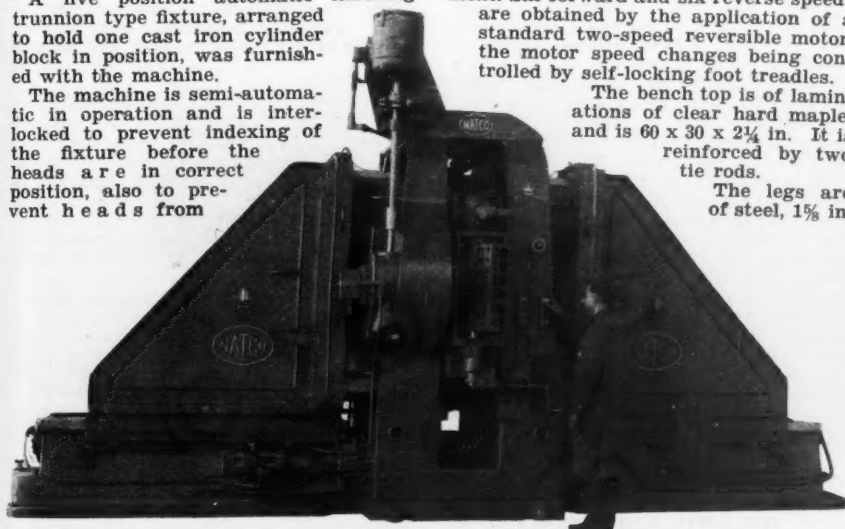
The weight of the machine is approximately 50,000 pounds.

## "Cataract" Six-Speed Motor Drive Unit

The illustration shows the "Cataract" six-speed motor drive unit, as adapted for the driving of a bench lathe. The unit was designed to eliminate the necessity for gears, clutches, and loose pulleys in the driving of bench lathes, hand screw machines, bench millers, and other small machine shop equipment. Six forward and six reverse speeds are obtained by the application of a standard two-speed reversible motor, the motor speed changes being controlled by self-locking foot treadles.

The bench top is of laminations of clear hard maple, and is 60 x 30 x 2 1/4 in. It is reinforced by two tie rods.

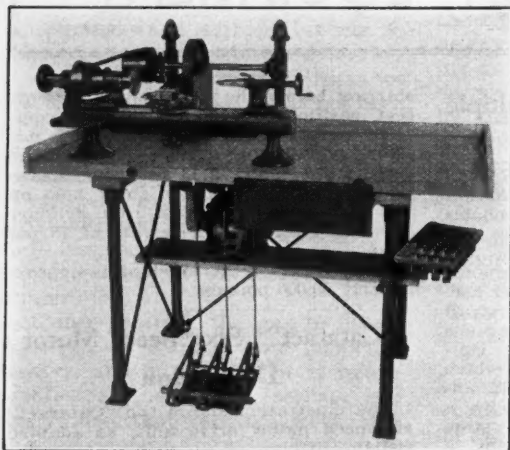
The legs are of steel, 1 1/2 in.



Special Natco Two-Way, Four-Headed Drilling, Counterboring, Facing, Chamfering, Countersinking, and Tapping Machine.



in diameter, and are held rigid by tension rods of  $\frac{1}{2}$  in. diameter. The tension rods can be adjusted to eliminate vibration. The legs are also threaded to



"Cataract" Six-Speed Motor Drive Unit

provide for adjustment where the floor is uneven.

The drive shaft is supported by self-aligning bearings. Individual adjustment is provided to maintain proper tension for the endless driving belts. A swinging collet board and the 14 x 24 x 5-in. steel drawer provide storage space for machine attachments.

A standard  $\frac{1}{2}$ -h. p., 220 volt, 60 cycle two-speed reversible motor of 1,800 and 900 r.p.m. is employed. The motor controls are mounted on a panel underneath and toward the rear of the bench. The control pedals are self-locking in the "down" position and may be released by touching the heel part of the pedal, thus affording complete foot control of the motor. Standard equipment includes the bench complete, motor, drawer, collet board, shelf for motor, drive shaft, endless belts and pulleys. The motor and controls are mounted in place and completely wired in conduit to the specifications of the Underwriters' Laboratory.

### "Thor" High Frequency Electric Drill and Reamer

The Independent Pneumatic Tool Co.,  
604 West Jackson Boulevard, Chicago,

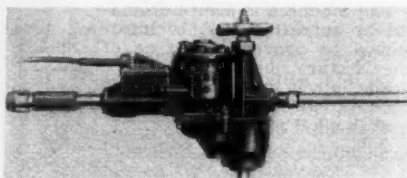
Illinois, has designed a new type of drill and reamer, which is a radical departure from the usual straight design of machine. As can be noted in the

illustration, the offset motor is separate from the frame and feed screw post, which design makes a short, rugged machine and permits the use of a feed of greater range. This design also permits the use of a short spindle, so necessary when operating in close places.

Another unusual feature of this new machine is the switch handle, which is of the safety roll type and is incorporated exclusively in Thor High Frequency Tools. This switch cannot be operated except by a turn of the operator's hand, and automatically closes when the hand is removed from the grip. This prevents accidents so commonly resulting in shipyards, railroad shops, and so on, from electric tools that have the older-type switch. The new Thor switch handle is similar in appearance to the throttle used on pneumatic drills. It

has no exposed slots and openings, and there is no possibility of dust or dirt entering through the handle.

The new machine is compact in design, perfectly balanced, and is very easily handled. Grip handle can be had



"Thor" High Frequency Electric Drill and Reamer

in place of feed screw, if desired. The tool is made in five sizes, as follows:

Size	Speed, R.P.M.	Drilling Capacity	Reaming Capacity	Wgt., Lbs.
HEA	525	$\frac{7}{8}$ "	$\frac{1}{2}$ "	33
HEB	325	1 "	$\frac{1}{2}$ "	33
HEN	215	$1\frac{1}{4}$ "	$\frac{1}{2}$ "	33
H3X	340	$1\frac{1}{2}$ "	$1\frac{1}{8}$ "	55
H3Y	250	$1\frac{3}{4}$ "	$1\frac{1}{8}$ "	55



## Carboloy Tool Kit for the Smaller Plant

Carboloy Company, Inc., 2485 East Grand Boulevard, Detroit, Mich., has announced the development of a tool



Carboloy Tool Manufacturing Kit

manufacturing kit designed to enable job-shops, small manufacturers and others with highly diversified, short-run production, to use Carboloy tools more extensively. The standard kit contains brazing and cleaning materials and an assortment of Carboloy tips and shanks for making four Carboloy tools  $\frac{3}{8}$  x  $2\frac{1}{2}$  in.,  $\frac{1}{2}$  x  $3\frac{1}{2}$  in.,  $\frac{5}{8}$  x 4 in., and  $\frac{3}{4}$  x  $1\frac{1}{4}$  x 8 in. Shanks are recessed to fit the Carboloy tips for either right or left-hand use—a feature which gives the user a choice of four out of eight possible tools. The shank and tip sizes, styles and quantities may be varied to meet special requirements when desired, with of course a corresponding adjustment in price.

In the past it usually has been necessary for plants of the job-shop type to make a sizable investment in order to stock an adequate assortment of finished Carboloy Tools. With the Carboloy Kit, this initial in-

vestment cost is considerably reduced and only a comparatively small outlay is necessary to meet the average job-shop requirements.

While reduced investment cost is an important advantage of this kit, there are also other benefits obtained which are equally worthwhile. On rush orders, for example, the plant having a small assortment of shanks and Carboloy tips on hand can immediately make up the required Carboloy tools and have them on the job in short order with all delivery time eliminated.

Flexibility of use is another feature. Through the development of a method for safely removing Carboloy tips from the shank, the user may change the tool style and size whenever desired and the investment cost of a Carboloy tip may be distributed over a wide range of jobs.

All of these, and other advantages, are described in a booklet recently published by the Carboloy Company, Inc., copies of which may be obtained by writing to the company.

## Dumore Type D-2 Wrench Tooth Grinder

Users of pipe wrenches fully appreciate the importance of sharp teeth in saving time and labor, and avoiding accidents. To aid in keeping the teeth of such wrenches sharp, The Dumore Company, Racine, Wis., has brought out



Dumore Type D-2 Wrench Tooth Grinder

the grinding unit shown in the illustration.

The Dumore Type D-2 Wrench Tooth Grinder is designed with a long arbor

which provides sufficient clearance for the largest of wrench jaws. Rated at  $\frac{1}{2}$  h.p. and running at 8,000 r.p.m., it has ample power and the necessary speed to grind wrench teeth quickly without danger of drawing the temper of the steel.

The motor is of the universal type and will operate equally well on a.c. or d.c. The armature is dynamically balanced to insure smooth operation and absence of vibration. Standard equipment includes the motor, wheel arbor, special

grinding wheel, 8 ft. cord, switch, and attachment plug.

## G-M Electric Soldering Iron Stand

An electric soldering iron stand that is said to effect savings of from 30 to 40 per cent in power consumption, besides overcoming many of the principal soldering troubles, has been announced by G-M Laboratories, Inc., 1733 Belmont Ave., Chicago, Ill. The most serious difficulties in soldering result from an overheated, dirty iron, and much defective soldering results from the tip of the iron becoming pitted and corroded from excessive heat. By keeping the iron, when not in actual use, at just the right soldering temperature, the G-M Stand is said to correct this trouble so that the tip of the iron remains well tinned for weeks.

The G-M Soldering Iron Stand has two cradles. When placed in the left hand cradle, the iron receives only sufficient voltage to keep it at the minimum and yet proper soldering temperature. When the iron is either actually in use or is placed in the right hand cradle, full line voltage is automatically applied to keep the iron up to temperature. Thus overheating, with all its attendant evils, is eliminated, and at the same time the power consumption is reduced to the minimum.



G-M Electric Soldering Iron Stand

## A Hardness Tester



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## Biax No. 0 Tapper

The Biax No. 0 Tapper, illustrated, is now being marketed by The Charles L. Jarvis Co., Gildersleeve, Conn. In this tapper power is transmitted from the machine spindle through a set of gears and pinions to clutches which can be controlled to drive the chuck as required. The tapper has a capacity of from No. 2-56 to  $\frac{1}{4}$  in. in steel, operating at a maximum speed of 3,500 r.p.m.



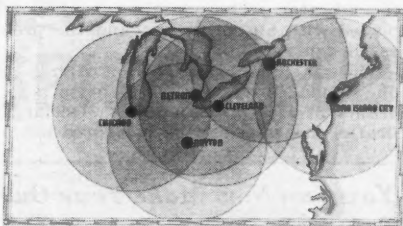
Biax No. 0 Tapper

The gears are of chrome nickel steel, hardened and ground, and the clutches are of Textolite. The clutches are self-adjusting. The reverse operates at double speed and double friction. The entire mechanism is contained in a cast Diallyte housing. The chuck, which is a Jacobs "Double-Grip," will hold either a square or round shank.

## Toledo Vibrator Filling Machine

Manufacturers who have had difficulty in the packing of products such as nails, washers, nuts, and other bulk parts can now pack them at lower costs and in less time by the use of the Toledo Vibrator Filling Machine, which has been announced by Toledo Precision Devices, Inc., Toledo, Ohio. The machine controls, automatically, the feed of materials from supply bins to the scales and the weighing out of predetermined amounts in packing operations.

The machine consists of a Toledo scale of high accuracy, an "electric eye" cut-off attachment, and a vibrator in which the parts to be packaged are held. It is simple to operate. Weights equivalent to that of the filled container are placed on the weight platter of the scale. The vibrator, attached to the scale, is supplied with the parts from a large hopper or bin nearby. The operator then presses a button which puts the vibrator in motion, and the parts run into the container. When the predetermined amount has entered the container, the electric cut-off stops the flow by stopping



## WITHIN EACH OF THESE AREAS

*A Danly Branch Office-Plant Offers You*

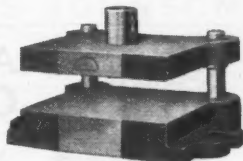
### Better Die Sets at Lower Cost

Within each of these areas is located a Danly Branch Office Plant capable of shipping within 24 hours any one of the 18 standard Danly types and 998 combinations of size, thickness and material of shoe and punch holder with many thousands more of pin and bushing combinations.

The fact that these five Branch Office-Plants are maintained is the greatest proof that each is able to offer manufacturers in its area better die sets at lower final costs and with faster deliveries. Any one of these offices will be glad to place before you complete information on how the Unique Danly Plan makes this possible . . .

#### Branches:

Long Island City, N. Y.,  
36-12 34th St.  
Detroit, Mich.,  
1549 Temple Ave.  
Cleveland, Ohio,  
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Dayton, O., 226  
N. St. Clair St.  
Rochester, N. Y.,  
16 Commercial St.



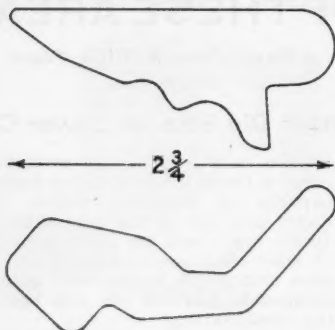
**DANLY MACHINE SPECIALTIES, Inc.**  
2122 South 52nd Ave. Chicago, Illinois

## DANLY DIE MAKERS SUPPLIES

the vibrator. The container is then replaced with an empty one and the process is repeated.

The machine is capable of filling 200 one-pound containers per hour to a tolerance of 1/64th of an ounce. On larger drafts, material can be measured out at

## You Can Now Make Your Own Temporary Dies for Short Runs in Your Own Shop



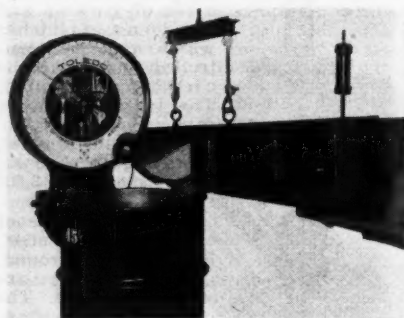
*Material—.015 Half Hard Cold Rolled Strip Steel*

**U**NDER this new and improved short run blanking process you will be able to make the tools for similar parts as shown, complete, in less than one hour. On receipt of \$25.00 I will forward you complete information together with the two tools to produce these parts for your own use in any standard punch press.

**Kermit E. Peterson** 2543 Chicago Ave. So. Minneapolis, Minn.

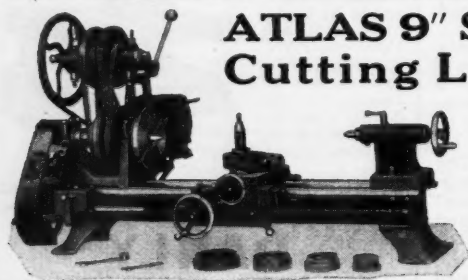
a speed of tons per hour. So accurate is the scale that the precise weights guarantee accuracy where the parts are sold by number.

If desired, the operation can be made even more automatic. The machine can be arranged so that, once the starting button is pressed, the filling and weigh-



Toledo Vibrator Filling Machine

ing operations will continue indefinitely and, after each filling, allow the operator time to check the weight and remove the container. The container can also be set into a production line and all containers passed under the vibrator by means of a conveyor, stopping long enough to be filled and then moved on—all automatically. A double cut-off attachment can also be applied by which the vibrator is slowed down when the container is nearly full, so that it will operate slowly until the exact amount required is poured into the container, when it stops. Thus there is no waste through overweight.



**ATLAS 9" Screw Cutting Lathe** **\$79<sup>00</sup>** Complete as shown, less motor

Pays For Itself Out of Profits

Will handle all sorts of light jobs. An accurate, strong lathe of best materials. 9" swing, 18" between centers. Larger sizes also. Six speeds. Cuts standard screws from 40 to 72 per inch. Uses 1/4 H. P. light current. We guarantee satisfaction or money back. Easy terms. Write for full details.

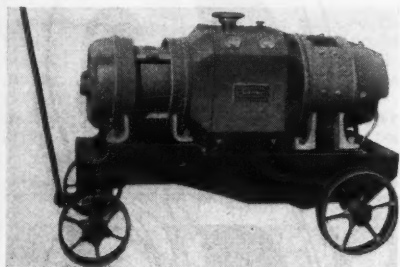
**ATLAS PRESS CO.**

1846 N. Pitcher St. Kalamazoo, Mich.

## Wilson Model SA Electric Welding Machine

A four-bearing, self-excited, dual-control arc welding machine, to be known as the Model SA, is now being marketed by the Wilson Welder & Metals Co., Inc., North Bergen, N. J. This machine was designed to meet the ever-increasing demand for the high amperages and arc voltage required in speed and shielded arc welding. It offers the advantage of a two-unit machine with a flexible coupling, which permits the changing of the motor or generator in case of failure, without that loss of time which results when trouble occurs in a dynamotor set, all units of which are mounted on a single shaft.

In the Model SA machine ruggedness of design is combined with simplicity



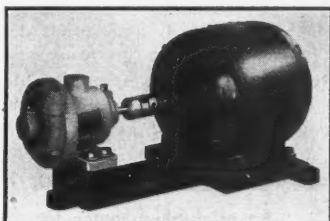
Wilson Model SA Electric Welding Machine

and compactness. No contact or connection is exposed. The only projecting parts are the control handles, which are located so that they are protected from injury. In addition, the voltmeter and ammeter are set at an angle, which greatly reduces the chance of damage.

Although all parts are protected, they are perfectly accessible. Every part except the motor and generator is visible, and can be adjusted or removed by loosening the wing nuts and lifting the side covers, which are hinged.

By means of the Wilson Dual Control System, the voltage and amperage may be set independently for readings. The machine will weld at the rated current in amperes, with 40 volts across the arc, producing a high speed shielded arc. It has a large overload capacity, and requires no exciter, with the result that the idling loss is very low. The efficiency is increased 10 per cent when using high speed rods, due to higher arc voltage. The machine is built to N. E. M. A. and U. S. Navy specifications.

## NEW SPIRAL-FLO PUMP



Simple in construction and design. No gears to wear out. Durable and free from trouble. Will pump oil, water, other liquids and mixtures. Not harmed by grit and chips. No leakage from gasket due to elimination of bolt holes. Discharge connection may be rotated to any position. Lifts up to 22". Capacities from 7 to 50 gallons per minute. Needs priming only when first installed.

*Send Coupon for Complete Information on the "Spiral-Flo" and "Brownie" Pumps.*

## TOMKINS-JOHNSON

620 North Mechanic Street, Jackson, Michigan

REPRESENTATIVES: L. F. Carlton, Chicago; S. G. Morris, Cleveland; Byron B. Holt, Detroit; Kirkby Machinery & Supply Co., Toledo; Geo. M. Pearce, Newark; Jenkins & Chaffee, Syracuse; J. Boyd Costes, Philadelphia; C. W. Marwedel, San Francisco; Edward K. Warde, Newcastle, Ind.; Joseph P. Pium, Cincinnati; W. C. Chapman, Baltimore; B. J. Bell, Pittsburgh; Herberts Machinery & Supply Co., Ltd., Los Angeles; John W. Vogler, St. Louis.

Tomkins-Johnson Company  
620 No. Mechanic St., Jackson, Michigan

Please send us full details and engineering data on the "Spiral-Flo" and "Brownie" pumps.

Name..... Position.....

Firm..... Address.....



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**L**OW DIE PRICE and quick delivery feature our short-run process stampings—Special and odd shapes of medium size blanks—Blanks may be pierced and formed—Production quantities of 100 to 500, and not to exceed 2000 pieces, recommended—Try this added service.

An established source for  
volume production stampings

Arbor Spacers

Cut washers, all materials

**DETROIT STAMPING CO.**

*Nation-Wide Service*

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**Don't waste time** whittling out bushings and bearings you can buy ready made. (Small lots even at big-run prices.) Write for Bunting's 8-page catalog showing 500 sizes of finished bronze bushings always in stock at the factory and all branches.

Bunting Cored and Solid Bronze Bars, and Bunting Lead Base Babbitt are other products that will save you time, money and worry. Ask any leading mill supply wholesaler.

**THE BUNTING BRASS & BRONZE CO.**

TOLEDO, OHIO

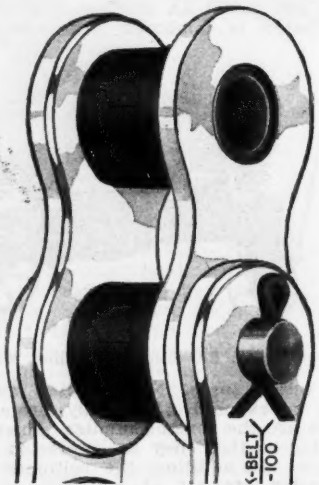
*Branches and Warehouses at: New York, Brooklyn, Chicago, Boston, Detroit, Cleveland, Philadelphia, Dallas, Kansas City, Los Angeles, Seattle, San Francisco. Export Office: Toledo.*

**BUNTING**  
QUALITY  
PHOSPHOR BRONZE  
**BUSHING BEARINGS**  
PATENTED

## Link-Belt "Silverlink" Roller Chain

A roller chain made with sidebars of alloy rolled steel that is heat treated to obtain maximum strength and toughness, and specially treated to resist corrosion, has been placed on the market by the Link-Belt Company, 912 South Michigan Ave., Chicago, Ill. The corrosion-resisting treatment gives the sidebars the appearance of silver; thus the chain is called by the trade name of "Silverlink."

Silverlink roller chain is made in all sizes from  $\frac{3}{8}$  in. to  $2\frac{1}{2}$  in. pitch, and in single or multiple widths. It is available with wheels, for any horsepower,



Design of Link-Belt "Silverlink" Roller Chain

and also with conveying attachment links in wide variety. Complete drives are available in sizes up to 225 h. p. and in speed ratios of 1:1 up to 8:1.

The chain is assembled with nickel steel case-hardened pins of the detachable type with cotter, or can be furnished riveted. The bushings are of solid steel, case-hardened. The rollers are of alloy steel, heat treated. The Link-Belt curled roller is made from strip steel having a strong fibrous structure, with the fiber running around instead of across the roller, so as to give the greatest strength and resilience to the roller (where the wear takes place) and offer the maximum resistance to shock. Uni-

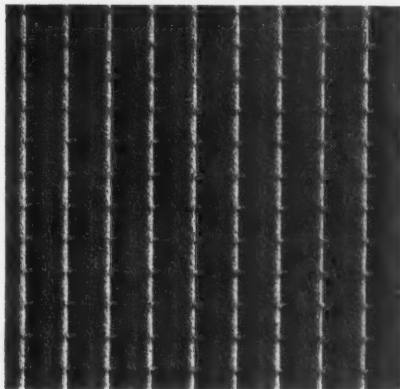


formity and close clearances are maintained throughout, assuring accuracy of pitch and smooth operation.

### Vim Tred "Non-Skid" Leather Belting

As the result of several years of experiment by the engineers of the research staff of E. F. Houghton & Co., Philadelphia, Pa., in an effort to develop a belt surface that would have the maximum pulling power, this firm has brought out the Vim Tred Leather Belting, which is the well-known Houghton Vim leather belt with a non-skid surface. The surface, shown in the illustration, is said to give the belt greater pulling power, smoother operation, freedom from slippage, longer life and lower operating cost, and other advantages.

Increased pulling power is claimed for this belt, due to the concentration of the tension between the belt and the pulley on the ribs of the Vim Tred surface without increasing the total tension of the belt. For example: in operating a four-inch flat belt under normal



Contact surface of Vim Tred Leather Belting, reproduced actual size.

tension of approximately 75 lb. per in. of width, the total tension of the belt is 300 lbs. Although somewhere near 50 per cent of the Vim Tred surface is indented so that only a part of the total surface is in contact with the pulley, the

## UNIFORMITY



AMERICAN SAW & MFG. CO.  
Springfield, Mass., U. S. A.

**U**NIFORMITY means lower operating costs, fewer replacements, better work, increased production. Save money by using the blade that's famous for uniformity. Lenox stakes its reputation on this important quality. Cut for cut, blade for blade, Lenox has no equal for performance and uniformity — under any conditions. Prove this money-making, money-saving value to yourself by ordering a box now from your mill supply house.

# LENOX

HACK  
SAWS

HAND  
SAWS



*"The Blade in the Plaid Box"*

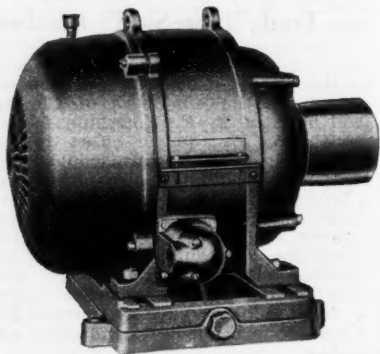
total tension of the drive remains at 300 pounds.

The Vim Tred surface is so produced that it will not wear down, as the tread is the natural and original surface of the leather. The flat ribs contact the pulley, causing the belt to "track," thus preventing swaying under sudden overload.

### Marble-Card Fan Seal-Type Motor

The Marble-Card Electric Company, Gladstone, Mich., has announced a line

of fan seal-type electric motors in sizes ranging from 2 h.p. at 900 r.p.m. to 30 h.p. at 1,800 r.p.m. It is claimed that the new type of motor is self-cooling, self-

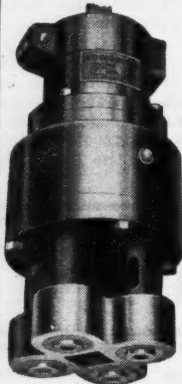


Marble-Card Fan Seal-Type Electric Motor

### FASTER DRILLING

WITH

#### Multiple Units



Speed up your drilling operations with a U.S. Multiple Drill head—designed to fit any type of drill press—to drill any number of holes. Fixed and adjustable spindles. Users everywhere regard the U.S. as the most efficient drill head.

*Tell us about your drilling problems. Send a blue print today!*

**The United States Drill Head Co.**

1954 Riverside Drive  
CINCINNATI, OHIO

cleaning, self-protecting, and—being entirely enclosed—is free from such hazards as dust, dampness, and fumes.

Among the advantages claimed for the motors is that they are so constructed that danger from fires and explosions is eliminated, maintenance costs are reduced, and the expense of special motor housing, boxings, or ventilating systems in order to protect the motors is rendered unnecessary. The motor requires no additional protection of any kind, and may be operated either inside or out-of-doors.

### "Opto-matic" Oiler

An automatic, visible lubricator for ring or ball bearing shafts, known as the "Opto-matic" Oiler, has been placed on the market by the Trico Fuse Mfg. Co., 1010 West McKinley Ave., Milwaukee, Wis. The Opto-matic Oiler is designed to automatically provide a continuous feed of oil to the bearing, while at the same time conserving oil when the machinery is not in motion. Thus bearing troubles due to lack of oil are eliminated and at the same time the waste and difficulties from oil soaking into motor windings and



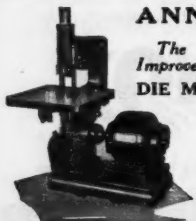
"Opto-matic" Oiler

### ANNOUNCING

The Improved

**OLIVER**

DIE MAKING MACHINE



With Many New Features

*Send for our new bulletin and learn how to cut die costs 30% to 60%.*

**OLIVER INSTRUMENT CO.**

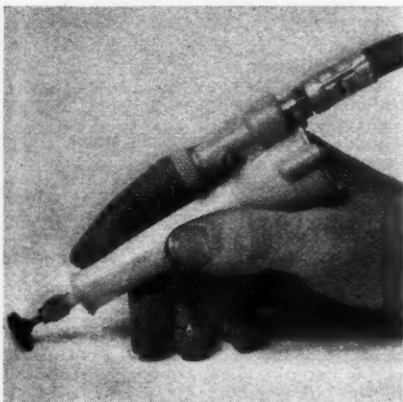
1430 E. Maumee Street, Adrian, Michigan

other mechanical apparatus are prevented.

It is only necessary to fill the reservoir annually or semi-annually as required; thus a minimum of maintenance cost is required. The micrometer adjustment permits a wide range of oil levels, merely by turning the glass oil reservoir.

### Madison-Kipp "Blue Midget" Air Grinder

A grinding tool that weighs but 7 oz. and operates at a speed of 40,000 r.p.m. has been announced by The Madison-Kipp Corporation, 219 Waubesa Street,



Madison-Kipp "Blue Midget" Air Grinder

Madison, Wis. This tool has been developed to fill the need for a small, yet efficient, air grinding tool for light, fine work. Company officials state that the grinder is being offered at a special low price which will make it possible for

**FINE TEETH START THE CUT**

SELF-STARTING

**REGULAR TEETH COMPLETE THE CUT**

**THESE SEVEN Outstanding Features mean greater value at no extra cost**

1. Starts cut at any angle. 2. Teeth will not catch in corners.
3. Starts quickly with a full cutting stroke. 4. Reduces cutting time.
5. No scraping to begin cut. 6. Will not slip off cutting line. 7. Distributes wear full length of blade.

MILFORD DUPLEX

*Order from your distributor*

**THE HENRY G. THOMPSON & SON CO.**  
Est. 1876      New Haven, Conn.

MILFORD  
DUPLEX  
PAT. U.S.A.



### Mummert-Dixon Facing Heads

8 Sizes—6" to 40"

We can't say much here . . . but if you write for a bulletin we'll show you how this tool will save you money.

**MUMMERT-DIXON CO.**  
120 Philadelphia Street  
Hanover, Pa.

## YOU CAN SAVE MONEY—



"Bored Straight  
and  
True to Size"

by using American Hollow Bored products. In addition, the high quality of American hollow bored forgings, steel shaftings, and hydraulic cylinders insure long, dependable service.

*Send blue prints for complete data and prices.*

**American Hollow Boring Co.**      2000 Raspberry St.  
Erie, Pennsylvania

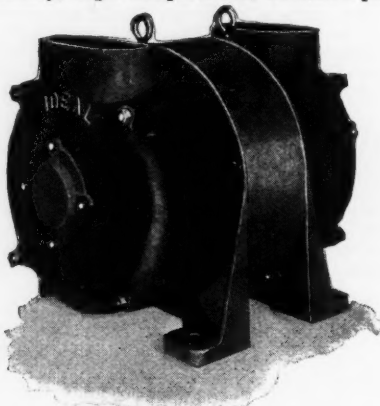
every tool or die maker to have one at his own bench.

All Kipp air tool accessories and wheels that are equipped with  $\frac{1}{8}$  in. diameter shanks can be used with the Blue Midget air grinder. Included with the grinder, as standard equipment, are eight feet of air hose, grinding wheel, bottle of Kipp oil, and Kipp syringe-type pressure oiler. This grinder is recommended for all light work and intermittent service.

### "Ideal" Pipe-Ventilated Motor

The Ideal Electric & Mfg. Co., Mansfield, Ohio, announces the development

of a motor that is especially adapted for the severe service encountered where the motor is exposed to excessive humidity, high temperature, abrasive par-



"Ideal" Pipe Ventilated Motor

## GUSHER COOLANT PUMP

### Here Is Why

so many machine tool manufacturers use GUSHER COOLANT PUMPS as standard equipment on the machines they build:

They are of simple and durable construction, consistent and reliable in performance, economical to operate with instant and steady flow of coolant; always ready for perfect performance.

And there is a GUSHER for any type or size of machine. It will pay you to investigate.



MODEL ULO

### The Ruthman Machinery Co.

536 E. Front St., Cincinnati, Ohio

ticles, heavy dust, corrosive fumes, lint, shavings, filings, or sawdust. The motor can also be used where totally-enclosed motors have been recommended because of fire hazards such as dust or explosive vapors.

The motor is a totally-enclosed poly-phase squirrel cage induction motor, ventilation being supplied by a large centrifugal fan which draws cool air in at one end and discharges the warm out at the other. The air intake may be extended to any convenient source and the outlet left free or extended to an outside wall as desired. The vent pipes are connected to the vent stacks shown in the illustration.

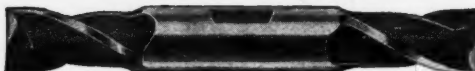
The motor is designed to meet all torque and inrush classifications for both squirrel cage and slip ring induction motors from 1 to 200 h.p., including

## WEL-DON DOUBLE-END MILLS

Short Runs  
and Rush Orders

WEL-DON Double-End Parallel-Shank End Mills meet today's conditions by reducing sharpening and set-up delays, and through

**HIGHEST SPEEDS** | Stocks in  
**FASTEST FEEDS** | Chief Cities



**The WELDON TOOL CO., 1426 W. 3rd St., Cleveland, Ohio**

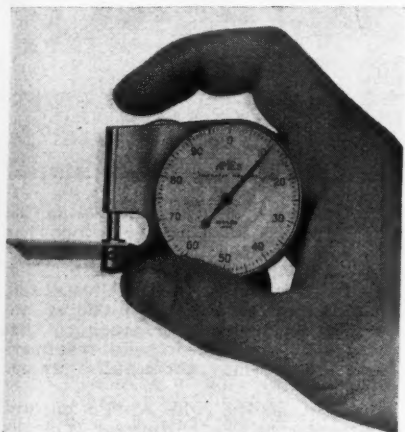
across-the-line start motors in all sizes up to 200 h.p. Motors are for 2 or 3 phase, 25, 30, 50, or 60 cycle current and all voltages up to 2,300 volts. The motor is also built for 2, 3, or 4 speeds.

### Ames Thickness Measure

A pocket dial indicator gage for use in measuring the thickness of sheet metal, cardboard, rubber, paper, or small mechanical parts has been placed on the market by the B. C. Ames Company, Waltham, Mass. The gage is thin, light in weight, and without corners or projecting parts; thus it makes an ideal gage for the vest pocket.

The moveable anvil is raised by using the finger or thumb to revolve the knurled wheel which projects slightly from the top of the gage. When released, the moveable anvil closes against the work, the hand on the dial indicating the amount of gap between the anvils or thickness of the work that is being measured. The moveable anvil closes with uniform spring tension when released, eliminating the element of personal touch in making the measurement.

The dial is graduated in thousandths of an inch, and fractions of the thou-

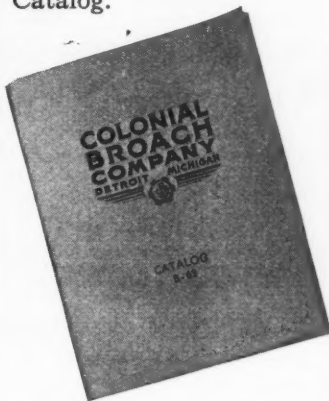


Ames Thickness Measure

sandth can easily be estimated. The accuracy of the tool is guaranteed within one-half thousandth at any point, and can easily be checked with size blocks or standards. Provision is made for ad-

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... should have a copy of this new Colonial Broach Catalog.



It contains 90 pages of pertinent data on broaching equipment which you can use to advantage.

**Write for your copy  
TODAY!**

**COLONIAL BROACH CO.**  
DETROIT, MICHIGAN

**COLONIAL BROACH CO.**  
145 Jos. Campau Street  
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Please send me a copy of your New Broach Catalog.

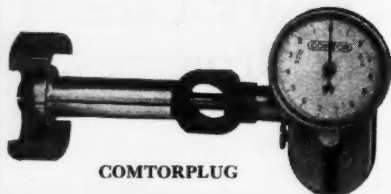
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## COMTOR



COMTORPLUG

### A MEASURING INTERNAL GAGE PRECISE TO ONE HALF TEN THOUSANDTH INCH

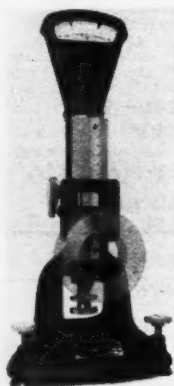
*Accurate—Durable  
Sensitive—Easy to Operate*

Suitable for both  
PRODUCTION and INSPECTION

$\frac{1}{4}$  inch to 8 inches

Send us your diameters and tolerances  
and let us make specific recommendations.  
We also make measuring  
external gages.

**THE COMTOR COMPANY**  
WALTHAM, MASS.



## THIS

and **6**

Other  
Instruments  
are made by the

**Societe  
Genoise**

for the

Measurement  
of Internal  
Diameters

Instruments for small, deep holes, for  
ball bearings as small as 4 mm., and for  
larger rings and bearings.

Write, stating dimensions of holes you  
have to measure and we will recommend  
the best equipment.

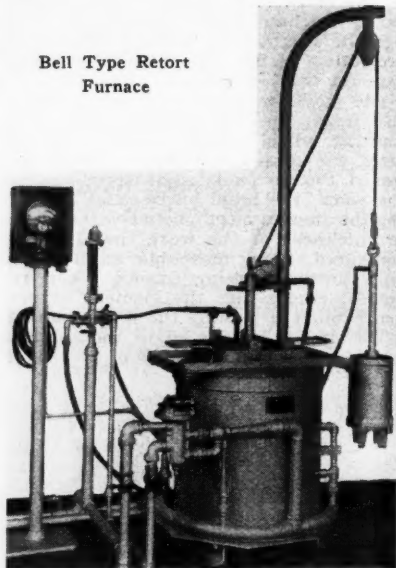
**THE R. Y. FERNER CO.**  
1133 Investment Bldg., Washington, D.C.

justment to zero. Made of non-rusting  
metal and with an unbreakable crystal,  
the gage should last indefinitely.

### Bell Type Retort Furnace

Manufacturers who are confronted  
with the necessity for either operating  
their heat treat departments on a more  
economical basis than heretofore or  
sending their work out to commercial

Bell Type Retort  
Furnace



heat treaters will be interested in the  
Bell Type Retort Furnace which has  
been placed on the market by the Amer-  
ican Gas Furnace Co., Elizabeth, N. J.  
This furnace, shown in the illustration,  
is adapted for carburizing, nitriding, an-  
nealing, hardening, normalizing, tem-  
pering, or for other heat treatment  
which may or may not require gaseous  
atmosphere.

Because of the wide range of heat  
treatment possible, the furnace is ideally  
suited for the jobbing shop where a va-  
riety of work is handled from day to  
day. It is, however, equally suitable  
for the production shop, as a battery  
of these furnaces will make possible a  
variety of operations, carried on simul-  
taneously. Or the number of furnaces  
in use may be varied according to pro-  
duction demands.



The work is handled into and out of the furnace in a bell type retort, shown at the right in the illustration. The bell with its work may be removed from the furnace and deposited elsewhere for slow cooling, or it may be withdrawn slowly to allow the pieces to be removed individually. The bells may be of any shape and size to suit the job. In use, the bell is entirely enclosed in the furnace, making it possible to maintain the work at a uniform heat and resulting in fuel economy.

By using extra bells, the furnace can be maintained in production practically continuously. The furnace is provided with an automatic temperature control, also a flow meter for checking the flow of gas through the retort. Two or more flow meters can be used where two or more gases are to be mixed, as, for example, in applying the Machlet Ni-Carb-Case.

### Kable Kord Belts and Belting

In response to a long-standing demand for a practically stretchless belt of great strength and yet of sufficient flexibility for service on high speed transmission

drives, the L. H. Gilmer Company, Wellington Street, Tacony, Philadelphia, Pa., has brought out the "Kable Kord" Endless Belt.

The Kable Kord Endless Belt is exceedingly strong, is practically stretchless, yet resilient, and is said by the manufacturer to be more flexible than any other type of belt of equal strength. The belt will operate over a small-diameter pulley and efficiently transmit power without slipping.

The belt is actually a combination of two belts in one. The lower section, which consists of layers of parallel pulling cords, does most of the actual transmitting of power, while the upper layer of heavy cable cords acts as a "contactor" belt. The contactor belt serves to hold the pulling cords tight to the pulley, thus preventing slippage with attendant injury to the belt and loss of power. The whole is built into a rubberized casing of strong fabric. There are no splices in the load-carrying cord; it is a genuinely endless belt, in which splices and separations cannot occur.

Kable Kord is also made non-endless and is shipped in rolls. It has the same general characteristics as those of the

## Reduce Screw Machine Feed Finger Expense with

No  
Pins



No  
Screws

### Morrison Style "B" Master Feed Finger and Pads

For All Makes of Automatic Screw Machines

#### CONSIDER THESE POINTS:—

- 1—We guarantee a 30 per cent to 80 per cent saving when feed tubes on your automatics are equipped with these feed fingers.
- 2—Morrison Style "B" Master Feed Fingers are heat treated, without compromise, for tension. The Pads are heat treated, without compromise, for long wear.
- 3—Scratching of polished, ground, plated or brass stock is eliminated by the use of our Nickle Cast Iron Pads.
- 4—Style "B" Pads for each size of stock are interchangeable between different makes of automatics with the same capacity. The saving is apparent — one set of pads for various automatics.
- 5—For sizes of automatics from No. 00 Brown & Sharpe to machines of 1½" capacity.

Also, Morrison Collets will reduce your Collet expense. By specializing for fifteen years in the manufacture of Collets and Feed Fingers for all makes of machines, we are enabled to supply you superior products at a lower cost. Write for Information and Prices.

**Morrison Machine Products, Inc.** ELMIRA, NEW YORK

endless belts. The pulling cords, however, are replaced by heavy non-stretching fabric. This insures permanency of belt connectors — such as Clipper or Alligator—holding tight when coupling the two ends together. So tough is this rubber fabric belt that it is said there is no hook that will pull through the fabric.

### S. I. P. Type MU-100 Measuring Machine

A universal measuring machine of small type, designated as MU-100, has



**BAUMBACH**

**STANDARDIZED**

**DIE SETS**

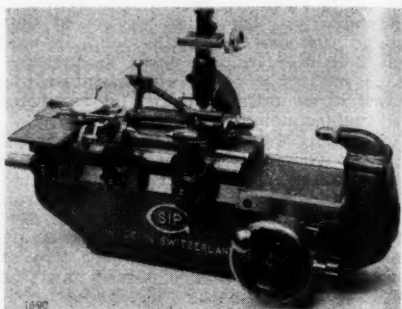
SEMI-STEEL      DROP FORGED STEEL

Standardized Die Sets, embodying many exclusive features, and a listing of more than 95,000 stock sizes, afford a service that is unsurpassed.

Send For Our New 208-Page Catalog

**E. A. Baumbach Mfg. Co.**  
1806 S. Kilbourn Ave., Chicago, Ill.

been developed by the Societe Genevoise d' Instruments de Physique of Geneva, Switzerland, and is being offered through their American agents, The R. Y. Ferner Company, Investment Building,

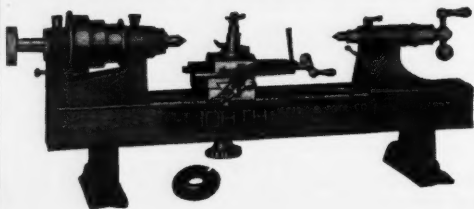


S. I. P. Type MU-100 Measuring Machine

Washington, D. C. The machine takes its designation from its capacity, which is 100 mm., or 4 in. It can be supplied graduated either in inches or millimeters and reads to an accuracy of 0.00005 in. or 0.001 mm.

Its field of use covers the checking of plug gages, the measurement of the pitch and thread diameters of thread gages, the testing of the gap of snap gages, the determination of the pitch and diameters of taps, and so on. It meets the need for an instrument with which to check working gages or callipers, without the necessity of keeping reference standards for such tests. Measurements are made by the use of a Societe Genevoise micrometer microscope of high precision, reading on an illuminated glass scale of special composition having a temperature coefficient of  $10.5 \times 10^{-6}$  per 1 deg. C. or

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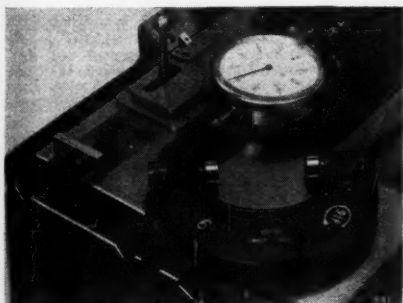
**HJORTH LATHE & TOOL COMPANY**  
60 STATE ST., BOSTON, MASS.

0.0000058 deg. F., practically equal to that of steel, so that all errors due to variations of temperature are avoided.

The bed of the machine has fixed contact anvils at each end and a slide between the two, rolling on steel balls, carries the moveable anvils and the glass scale. The displacements of the slide are read directly by the measuring microscope to 0.000005 in. and estimations may easily be made to one-tenth of this amount.

The carriage may be moved rapidly by means of a large hand wheel which is also provided with a slow motion device for final settings. The anvils at the right end of the carriage and the right end of the machine are optically flat, 23/64 in. in diameter, and are made of synthetic sapphire that is harder than steel. For external measurements either a flat measuring table mounted on balls, or one carrying centers, similarly mounted for support of plug or thread gages, is supplied. For internal measurements, a new method of making contacts is used which permits establishment of the zero setting by pressure of the spring piston against the carriage in the same manner as in external measurements or in the setting of the gap of the snap gage.

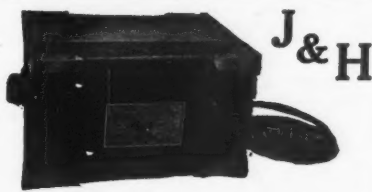
The anvil on the left end of the carriage consists of two flat-surfaced pieces



Showing unique method of taking zero reading for measurement of snap gage.

separated by a gap permitting the other anvil, mounted on the left end of the bed, to pass between and beyond them when the carriage is moved to the extreme left. This movement is carried far enough so that a flat gage, of the Jo block type, of 0.2 in. thickness, can be

(Continued on page 53)



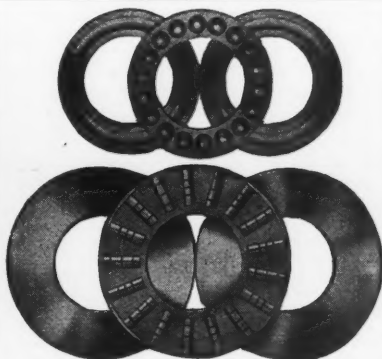
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**Chucks—Key and Keyless:** Bulletin No. 120A, issued by T. R. Almond Mfg. Co., Ashburnham, Mass., describes and illustrates the line of key and keyless geared nut and ball bearing drill chucks made by this firm. Copy free upon request.

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**"Fastenings"** is the title of a booklet, issued by the Parker-Kalon Corporation, 192-196 Varick Street, New York, N. Y., in which are included the results of surveys made in fourteen different plants as to the efficiency of fastening methods. Copy free upon request.

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**Double-Life End Mills:** Weldon Double-End Type End Mills, made with blades on each end, are described in Catalog No. 6, issued by The Weldon Tool Company, 1426 West Third Street, Cleveland, Ohio. Other small tools made by this firm are also described and illustrated in this catalog.

## New Shop Equipment

(Continued from page 51)

placed between them. Thus the zero setting is established in the same manner as the setting on the snap gage. A table is provided for support of the snap gage in these tests.

Pitch of taps can be measured by pulling the top of the frame forward and downward until the contact point rests between the threads of the tap (or thread gage) mounted between centers. By setting the dial indicator to zero and then checking the readings as

the carriage is moved from one thread to another, the exact amount of pitch can be determined.

The machine is 25 x 18 x 16 in. and weighs, net, 128 lb. The maximum distance between centers is 8¾ in. and the maximum diameter of plugs that can be admitted is 2 in. Discs, however, can be measured up to 4¾ in. when supported on the flat table. Taps up to 9½ in. in length can be supported between centers for pitch measurements. Accessories include wires for measuring screw threads and prisms for measurements of root diameters.



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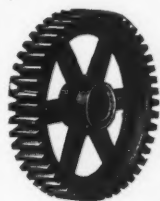
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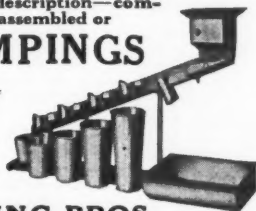
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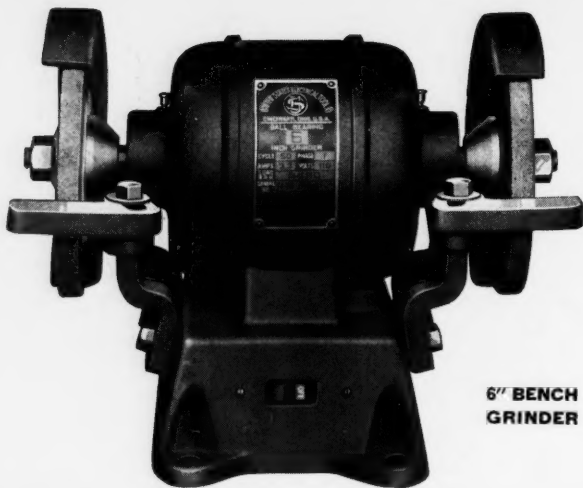
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